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REPORT

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OF THE

TESTS OF METALS

AND

OTHER MATERIALS

FOR

INDUSTRIAL PURPOSES

MADE WITH THE

UNITED STATES TESTING MACHINE AT WATERTOWN ARSENAL, MASSACHUSETTS.

DURING

THE FISCAL YEAR ENDED JUNE 30, 1895.

DECEMBER 12, 1895.—Referred to the Committee on Military Affairs and ordered to be printed.

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LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

The report of the commanding officer of the Watertown Arsenal of "Tests of iron, steel, and other materials for industrial purposes" made with the United States testing machine during the fiscal year ended June 30, 1895.

WAR DEPARTMENT,
Washington, D. C., December 9, 1895.

SIR: I have the honor to transmit, herewith, as required by existing law, the report of the commanding officer of the Watertown Arsenal of "Tests of iron, steel, and other materials for industrial purposes" made with the United States testing machine during the fiscal year ended June 30, 1895.

Very respectfully,

DANIEL S. LAMONT,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

OFFICE OF THE CHIEF OF ORDNANCE,
UNITED STATES ARMY,
Washington, D. C., November 25, 1895.

SIR: I have the honor to submit for transmission to Congress, as required by law, the report of the commanding officer of the Watertown Arsenal of "Tests of iron, steel, and other materials for industrial purposes," made with the United States testing machine during the fiscal year ended June 30, 1895.

Very respectfully,

D. W. FLAGLER,
Brigadier-General, Chief of Ordnance.

The SECRETARY OF WAR.

WATERTOWN ARSENAL,
Watertown, Mass., November 19, 1895.

SIR: I have the honor to submit herewith the following report of tests of materials made at this arsenal during the fiscal year ending June 30, 1895, in compliance with the requirements of law:

The total number of specimens tested during the year was 2,365, classified as follows:

Gun specimens	100
For Ordnance Department	221
For other Government Departments	177
Investigative tests	1,026
Tests for private parties	841
Total	2,365

The receipts and expenditures were as follows:

Amount appropriated for testing machine and testing work	$10,000.00
Received during the year from private parties	904.32
Total received	10,904.32
Amount expended for service and labor	8,806.81
Amount expended for light, power and tools, implements and materials for tests	2,097.51
Total expended	10,904.32

Tests made on account of the Ordnance Department comprise specimens from 8, 10, and 12 inch B. L. rifles, steel for barrels and receivers for small arms, gun-carriage castings and forgings, cast iron for shot and shell, and bronze castings, all representing current work of the Department.

For other branches of the Government there were tests of chains, chain iron, shackles, and swivels for the Navy Department and light house inspectors; also shot lines for the Life-Saving Service.

Steel bars were tested for standardizing the testing machine of a private manufacturer engaged upon work for the Ordnance Department.

Pig and cast irons and bronze from the arsenal foundry have been tested, and chemical analyses of the same made. Also a general class of miscellaneous tests have been made representing work fabricated at this arsenal.

A large number of copper cylinders, intended for use in gauges for determining powder pressures in guns, have been initially compressed, and tables prepared showing the amount of compression under different loads.

The manner of preparing the tables may be described as follows: A copper is placed in the testing machine and loaded with an initial load of small amount, the coppers for small-arms gauges being initially loaded with 100 pounds, and those for guns of large caliber being initially loaded with 300 pounds.

A micrometer attached to the compression buttresses of the testing machine is then adjusted to zero reading. Loads are now applied to the copper and gradually increased with increments corresponding to 1,000 pounds per square inch on the pressure gauges to which the coppers respectively belong.

Micrometer readings are taken at each increment of load, thus showing the total compression of the copper under the applied loads.

Ten coppers of each lot are treated in this manner, and the mean results are taken as representing the compression of the lot while under load.

In the use of the coppers they would be measured while free from compression loads, therefore a correction of the mean compression becomes necessary to allow for the resilience of the material when the loads are released. The tabular results as finally used show the mean permanent set which occurs under each increment of load.

The original lengths of the coppers should be ".5000. In the process of manufacture a maximum of variation in length of ".0005 may be expected.

Under loads the different coppers are compressed different amounts, and among a given lot of coppers some would display greater and others less compressibility than the mean tabulated curve of permanent sets.

One of the results attained, due to the initial compression of the coppers before use, consists in the fact that at the load of initial compression all coppers are brought to a state of equality; that is, under the next higher pressures applied the succeeding decrements of length will be nearly alike for the various coppers of the same lot, the differences between the amounts of compressive sets under the initial loads having no influence on the indicated results of the pressure gauges.

From these remarks it follows that the proper use of the table of pressures requires that the individual coppers be measured before and after use in the pressure gauges, and the decrements of length thus found compared with the decrements of length shown in the table, the origin of the latter being taken at the load under which the coppers were initially compressed,

An examination was also made of some coppers which had been used in determining the pressures in a 10-inch gun. These were examined for the purpose of ascertaining under what loads a renewal of the permanent flow of the coppers took place with reference to the apparent powder pressures developed in the gun.

The coppers of one lot of initial compression, those of 40,000 pounds per square inch, promptly renewed flow upon being loaded beyond the apparent powder pressure received by them.

Those of the lower initial compression, 32,000 pounds per square inch, behaved somewhat differently. They require higher loads, ranging from zero to 2,940 pounds per square inch, referred to the area of the pressure gauge, to renew rapid flow.

Earlier experiments on coppers suddenly compressed by means of hammer blows gave similar results to the latter coppers, higher loads in the testing machine being required to renew rapid flow than would be expected from the amount of compression caused by the hammer.

The peculiar effects of the hammer-blow experiments and of the powder pressures on the coppers of 32,000 pounds initial compression were not materially unlike each other in respect to the magnitude of the differences developed.

A thorough examination was made of the internal strains in an experimental steel forging which had been cooled from the bore. Slices were taken from different parts of the forging and concentric rings detached from these slices. The strains thus released in the detached rings were ascertained by measurements of surface diameters on the rings before and after they were detached. The stresses corresponding to the strains relieved were computed and are recorded with the details of the series of determinations.

Rings from this forging were examined after moderate annealing, which relieved a portion of the internal strains.

Following the main series, some special observations were made on

the elastic limits of the detached rings, both in the direction of the initial strains and under the opposite kind of stresses.

As the rings were successively detached, those remaining in the slice were examined. The measurements thus taken showed the various stages in the readjustment of equilibrium of the internal strains.

The maximum tensile stresses displayed by the forging in the state it existed when received for examination was 43,900 pounds per square inch, the compressive stress reaching 64,300 pounds per square inch. These values were found in the breech slice. At the muzzle end the tensile and compressive stresses were 32,800 and 54,690 pounds per square inch, respectively.

As the rings were successively detached, the stresses in the remaining parts of the slice were modified, the position of the neutral axis changed, receding from the sides of the slice from whence were taken the detached rings, and metal which existed in the forging in a state of initial tension, upon the removal of rings containing initial compression metal, itself passed through a neutral state and then into one of initial compression.

In this readjustment of strains some of the intermediate rings originally in compression were exposed to augmented compression strains as the supporting metal below was removed.

In this manner ring No. 2 of the breech slice, which was originally under 52,500 pounds per square inch in the forging, was exposed to a stress of 74,600 pounds per square inch compression when the slice reached the stage that ring No. 2 was at the surface of the bore.

The stresses in the breech slice, annealed, range from 17,900 pounds per square inch tension to 33,000 pounds per square inch compression, the maximum stresses in each case being found in the metal a short distance below the surfaces of the bore and the exterior of the forging.

These results show that by means of suitable treatment in heating and cooling, and also by subsequent annealing or by the removal of certain rings, a wide range in the state of internal strains may be accomplished.

A number of samples of riveted joints in steel boiler plate were tested, with material contributed by the American Boiler Manufacturers' Association, the object of the tests being to ascertain the relative shearing strength of steel and iron rivets in single-riveted seams, and also the strength of some special multiple riveted seams.

A series of railroad-track experiments were conducted in cooperation with the officials of the Pennsylvania Railroad, in which the fiber stresses in rails of different weights, from 60 to 100 pounds per yard, and loaded with heavy passenger and freight locomotives, were ascertained; also the depression of the track ascertained when loaded by the same locomotives with rails on cinder, gravel, and stone ballast, and tests showing the slope or inclination of the rail under the influence of the different wheels.

Much importance attaches to experiments of this class, which illustrate the actual behavior of material in service, supplementing and aiding the application of results obtained in the testing machine.

The moments of resistance of the several sections of rails increased with their weight per yard, but the peculiar conditions of the track in individual cases more or less obscured the relative strength and rigidity of the rails themselves.

There were illustrations in which the lighter sections showed lower fiber stresses than the heavier ones under the same wheels of the engine,

showing the importance of obtaining uniform conditions of support from the ties, so far as practicable.

The magnitude of the stresses developed under the static conditions of these tests shows that rails are often strained higher than material is supposed to be in the case of bridges or other permanent structures exposed to variable live loads.

The relative efficiency of the different kinds of ballast in their influence on the depression of the rails when loaded is shown by these experiments.

The slope tests indicate the wave motions which accompany the passage of a locomotive along the track.

The tests of building material, including stones, brick, and tiles, are continued from the previous year. In addition to the ordinary compression tests of the material, shearing and transverse tests have been made.

Either from direct loading, or from the yielding of the mortar, building material is often exposed to shearing and transverse stresses, and it is believed that the resistance of the material in these directions should be considered as well as the direct crushing strength.

It has been shown that a sensible loss in transverse strength results from the exposure of stones to the range of temperature from 32° to 212° F. in the water baths used in the coefficient of expansion determinations.

Higher temperatures will be reached in a hot-air muffle, and the phenomena which attend will be investigated. In this manner it is expected that the fire-resisting properties of stones may be properly defined and the progress of disintegration noted.

Bricks in considerable variety from yards in different parts of the country have been examined.

The scope of these tests has covered the same features as stone tests.

With these representative tests of material at hand, gathered from different sections of the country, it remains to examine more in detail the influence of methods of manufacture whereby an improvement in product may be obtained.

Tests by compression of large sticks of Douglas fir wood have been made, and some observations taken on the expansion and contraction of wood by the absorption of moisture.

The endurance tests of rotating shafts have been continued, and an examination of the material made after rupture by the repeated alternate stresses of these experiments for the further investigation of the phases of deterioration passed through by the metal preceding ultimate rupture.

Chemical analyses have been made of much of the important material tested during the present year.

The report is followed by a list of the private parties who have had tests made in accordance with an act of Congress, which makes the testing machine available for any citizen of the country.

The operations of the testing machine have as heretofore been personally directed by Mr. J. E. Howard, C. E., to whose extreme carefulness and expertness the reliability of the reports of tests is principally due.

The need of a smaller testing machine to relieve the large one of some of its work becomes more apparent as time advances and the scope and number of the tests is enlarged. We are now some two years behind in our experimental tests.

The addition of an impact or drop testing machine is also one of the necessities of this Department.

Micro-metallography as an adjunct to the work of the testing machine and chemical analysis in determining the qualities of metals has assumed an importance that renders it an essential part of any complete testing laboratory. It is expected to add this department to the others in the near future.

Very respectfully, your obedient servant,

J. W. REILLY,
Major, Ordnance Department, U. S. A., Commanding.

The CHIEF OF ORDNANCE, U. S. A.,
Washington, D. C.

REPORT

OF THE

TESTS OF METALS AND OTHER MATERIALS

FOR

INDUSTRIAL PURPOSES,

MADE WITH THE

UNITED STATES TESTING MACHINE AT WATERTOWN ARSENAL, MASSACHUSETTS,

DURING

THE FISCAL YEAR ENDED JUNE 30, 1895.

TABLE OF CONTENTS.

	Page.
1. 8-inch steel B. L. rifles, tubes and jackets	13
2. 1 inch steel B. L. rifles, tubes and jackets	37
3. 1 inch steel B. L. rifles, tubes and jackets	59
4. Rifle-barrel steel, .30 caliber	87
5. Rolled barrels, .30 caliber	115
6. Receivers of rifles, .30 caliber	137
7. 12-inch gun lift, top carriage, steel casting	145
8. Piston rod for 12-inch B. L. barbette carriage	147
9. Gun-lever axle, 8-inch disappearing carriage	148
10. Steel specimens for standardizing testing machine	149
11. Steel bar from arsenal shops	156
12. Cast iron, Watertown Arsenal, cupola iron	157
13. Pig iron, cast iron, and semi-steel	169
14. Chains, chain iron, shackles, and swivels	185
15. Bronze	195
16. Copper cylinders for pressure gauges	209
17. Bronze, Tobin	223
18. Helical springs	225
19. Internal strains in experimental steel forging	233
20. Wrought-iron casting	277
21. Wrought-iron, Burden's	278
22. Wrought-iron, Norway, Ulster	279
23. Riveted joints	281
24. "Vibration-proof" bolts and nuts	291
25. Railroad-track experiments	297
26. Hotchkiss 4.7-inch rapid-fire gun	311
27. Building material, stones, bricks, and tiles	317
28. Douglas fir wood, compression	537
29. Expansion and contraction of wood, oak and pine	567
30. Endurance of rotating shafts	575
31. Annular tension specimens from endurance shafts	599
32. Chemical analyses, steels from Springfield Armory	702
33. Chemical analyses, steels and cast iron	703
34. Shot lines	705
35. Private tests	712

8-INCH STEEL B. L. RIFLES.

SPECIMENS FROM TUBES AND JACKETS.

8-INCH STEEL B. L. RIFLES.

SPECIMENS FROM TUBES AND JACKETS.

TUBE.

No. 5230.

Marks, $\frac{5365\ B}{BT,\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	.....	.....	
10,500	42,000	.001400	.000067	.000033	.000033	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001533	.000066	.....	.....	
11,500	46,000	.001600	.000067	.....	.....	Elastic limit.
11,750	47,000	.005000	.003400	.....	.....	
12,000	48,000	.006933	.001933	.....	.....	
12,250	49,000	.007667	.000734	.....	.....	
12,500	50,000	.008500	.000833	.....	.....	
12,750	51,000	.009333	.000833	.....	.....	
20,960	83,840	.1233	.113967	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	83,840
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.2400
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		"1.5 from neck
Character of broken surface		silky
Elongation of inch sections		".19, ".39*, ".14

TUBE.

No. 5229.

Marks, $\frac{5365\ B_1}{M\ T,\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001367	0.	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001533	.000066	.....	.....	
12,000	48,000	.001567	.000034	.....	.....	
12,250	49,000	.001600	.000033	.....	.....	
12,500	50,000	.001667	.000067	.....	.....	Elastic limit.
12,750	51,000	.002500	.000833	.....	.....	
13,000	52,000	.004167	.001667	.....	.....	
13,250	53,000	.006667	.002500	.....	.....	
13,500	54,000	.007667	.001000	.....	.....	
13,750	55,000	.008333	.000666	.....	.....	
21,980	87,920	.1200	.111667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,920
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.1967
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1″.08 from neck
Character of broken surface		Silky
Elongation of inch sections		″.09, ″.17, ″.33*

TUBE.

No. 5287.

Marks, $\frac{5091\ B_1}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	.000033	.000033	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	
11,750	47,000	.001567	.000034	.....	.....	
12,000	48,000	.001633	.000066	.....	.....	
12,250	49,000	.001700	.000067	.....	.....	Elastic limit.
12,500	50,000	.003333	.001633	.....	.....	
12,750	51,000	.005533	.002200	.....	.....	
13,000	52,000	.007000	.001467	.....	.....	
13,250	53,000	.007667	.000667	.....	.....	
13,500	54,000	.009000	.001333	.....	.....	
21,420	85,680	.1400	.1310	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,680
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		″.13, ″.37°, ″.12

TUBE.

No. 5286.

Marks, $\frac{5091\ B_2}{M\ T,\ ^2_1}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	.....	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	.....	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	.....	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001433	0.	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001500	.000033	.....	.....	
12,000	48,000	.001533	.000033	.....	.....	
12,250	49,000	.001600	.000067	.....	.....	
12,500	50,000	.001667	.000067	.....	.....	Elastic limit.
12,750	51,000	.002733	.001066	.....	.....	
13,000	52,000	.004333	.001600	.....	.....	
13,250	53,000	.007667	.003334	.....	.....	
13,500	54,000	.009333	.002666	.....	.....	
13,750	55,000	.010667	.001334	.....	.....	
20,910	83,640	.1400	.129333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	83,640
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2467
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1″.8 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.16, ″.44*, ″.14

TUBE.

No. 5296.

Marks, $\frac{5584\ B_1}{B\ T,\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001333	.000133	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001467	.000067	.....	.....	
11,000	44,000	.001500	.000033	.....	.....	
11,250	45,000	.001567	.000067	.....	.....	Elastic limit.
11,500	46,000	.001667	.000100	.....	.....	
11,750	47,000	.001800	.000133	.....	.....	
12,000	48,000	.002667	.000867	.....	.....	
12,250	49,000	.004667	.002000	.....	.....	
12,500	50,000	.006367	.001700	.....	.....	
21,720	86,880	.1267	.120333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,880
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.1933
Elongation per inch under strain at elastic limit	do...	.001567
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		".12, ".36", ".10

TUBE.

No. 5295.

Marks, $\frac{5584\ B}{M\ T, M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001467	.000067	.....	.....	
11,250	45,000	.001533	.000066	.....	.....	
11,500	46,000	.001633	.000100	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001700	.000033	.....	.....	Elastic limit.
12,250	49,000	.001900	.000200	.....	.....	
12,500	50,000	.003000	.001100	.....	.....	
12,750	51,000	.004667	.001667	.....	.....	
13,000	52,000	.006000	.001333	.....	.....	
13,250	53,000	.007000	.001000	.....	.....	
21,400	85,600	.1267	.1197	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,600
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		".85 from neck
Character of broken surface		silky
Elongation of inch sections		".14, ".17, ".38*

TUBE.

No. 5318.

Marks, $\frac{6178\ B}{B\ T, M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3."

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001100	.000167	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001500	.000067	.....	.....	
11,500	46,000	.001533	.000033	.....	.....	
11,750	47,000	.001600	.000067	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	Elastic limit.
12,500	50,000	.003667	.002000	.....	.....	
12,750	51,000	.005667	.002000	.....	.....	
13,000	52,000	.006667	.001000	.....	.....	
13,250	53,000	.007667	.001000	.....	.....	
13,500	54,000	.008667	.001000	.....	.....	
22,460	89,840	.1300	.121333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,840
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2033
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1".18 from neck
Character of broken surface		silky
Elongation of inch sections		".38,* ".23, ".10

TUBE.

No. 5312.

Marks, $\frac{6178\ B}{M\ T, M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	.000033	.000033	
10,000	40,000	.001333	.000166	.....	.....	
10,500	42,000	.001400	.000067	.000033	0.	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001500	.000033	.....	.....	
11,500	46,000	.001567	.000067	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001667	.000067	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	
12,500	50,000	.001700	0.	.....	.....	
12,750	51,000	.001767	.000067	.....	.....	Elastic limit.
13,000	52,000	.001967	.000200	.....	.....	
13,250	53,000	.002167	.000200	.....	.....	
13,500	54,000	.003000	.000833	.....	.....	
13,750	55,000	.003933	.000933	.....	.....	
14,000	56,000	.008500	.004567	.....	.....	
23,210	92,840	.1167	.1062	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,840
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.1933
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1″.03 from neck
Character of broken surface		silky
Elongation of inch sections		″.34, ″.14, ″.10

TUBE.

No. 5343.

Marks, $\frac{5103\ B,\ F,}{B\ T,\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001333	.000200	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001400	0.	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001500	.000067	.....	.....	
11,500	46,000	.001567	.000067	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	Elastic limit.
12,000	48,000	.003667	.002067	.....	.....	
12,250	49,000	.005000	.001333	.....	.....	
12,500	50,000	.006167	.001167	.....	.....	
12,750	51,000	.007167	.001000	.....	.....	
13,000	52,000	.008333	.001166	.....	.....	
21,020	84,080	.1400	.131667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	84,080
Elastic limit per square inch of original section	do...	47.000
Elongation per inch after rupture	inch..	.2367
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.184
Reduction in area after rupture, per cent of original section		54.6
Position of rupture		at middle of stem
Character of broken surface		fine silky
Elongation of inch sections		″.13, ″.44, ″.14

TUBE.

No. 5342.

Marks, $\frac{5103\ B,\ F_1}{M\ T,\ M}$
Diameter, $\frac{7}{8}$".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001500	.000033	.....	.....	
11,750	47,000	.001567	.000067	.....	.....	
12,000	48,000	.001600	.000033	.....	.....	
12,250	49,000	.001667	.000067	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	Elastic limit.
13,000	52,000	.004267	.002534	.....	.....	
13,250	53,000	.005267	.001000	.....	.....	
13,500	54,000	.006667	.001400	.....	.....	
13,750	55,000	.007600	.000933	.....	.....	
14,000	56,000	.008833	.001233	.....	.....	
21,940	87,760	.1200	.111167	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,760
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.2033
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1". 5 from neck
Character of broken surface		silky
Elongation of inch sections		".13, ".34", ".15

JACKET.

No. 5238.

Marks, $\frac{5750\ B_3}{B\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000600	.000300	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
10,000	40,000	.001300	.000367	.000033	.000033	
11,000	44,000	.001400	.000100	.000033	0.	
11,250	45,000	.001467	.000067	.....	.....	
11,500	46,000	.001500	.000033	.....	.....	
11,750	47,000	.001533	.000033	.....	.....	
12,000	48,000	.001567	.000034	.....	.....	
12,250	49,000	.001633	.000066	.....	.....	
12,500	50,000	.001667	.000034	.....	.....	Elastic limit.
12,750	51,000	.003667	.002000	.....	.....	
13,000	52,000	.005500	.001833	.....	.....	
13,250	53,000	.006566	.001167	.....	.....	
13,500	54,000	.007667	.001060	.....	.....	
13,750	55,000	.008500	.000833	.....	.....	
22,550	90,200	.1400	.1315	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,200
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		".70 from neck
Character of broken surface		silky
Elongation of inch sections		".36", ".15, ".1

JACKET.

No. 5237.

Marks, $\frac{5750\ B}{M\ T,\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001333	.000366	0.	.....	
11,000	44,000	.001433	.000100	0.	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	
11,750	47,000	.001567	.000034	.....	.....	
12,000	48,000	.001633	.000066	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	Elastic limit.
13,000	52,000	.002967	.001234	.....	.....	
13,250	53,000	.004667	.001700	.....	.....	
13,500	54,000	.006000	.001333	.....	.....	
13,750	55,000	.006833	.000833	.....	.....	
14,000	56,000	.008000	.001167	.....	.....	
22,760	91,040	.1267	.1187	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,040
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1″.17 from neck
Character of broken surface		silky
Elongation of inch sections		″.33*, ″.21, ″.11

JACKET.

No. 5292.

Marks, $\frac{6088\ B}{B\ T, M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
11,000	44,000	.001467	.000134	0.	.....	
11,250	45,000	.001500	.000033	.....	.....	
11,500	46,000	.001533	.000033	.....	.....	
11,750	47,000	.001567	.000034	.....	.....	
12,000	48,000	.001600	.000033	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	
12,500	50,000	.001667	.000034	.....	.....	
12,750	* 51,000	.001700	.000033	.....	.....	Elastic limit.
13,000	52,000	.001867	.000167	.....	.....	
13,250	53,000	.002100	.000233	.....	.....	
13,500	54,000	.003000	.000900	.....	.....	
13,750	55,000	.003833	.000833	.....	.....	
14,000	56,000	.005000	.001167	.....	.....	
23,710	94,840	.1167	.1117	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	94,840
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.1833
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1".5 from neck
Character of broken surface		silky
Elongation of inch sections		".09, ".33*, ".13

JACKET.

No. 5291.

Marks, $\frac{6088\ B}{M\ T, M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001267	.000300	0.	.....	
11,000	44,000	.001400	.000133	.000033	.000033	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001500	.000033	.....	.....	
12,000	48,000	.001533	.000033	.....	.....	
12,250	49,000	.001600	.000067	.....	.....	Elastic limit.
12,500	50,000	.001700	.000100	.....	.....	
12,750	51,000	.001800	.000100	.....	.....	
13,000	52,000	.003000	.001200	.....	.....	
13,250	53,000	.004400	.001400	.....	.....	
18,500	54,000	.005400	.001000	.....	.....	
23,520	94,080	.1433	.1379	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	94,080
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″ from neck
Character of broken surface		fine silky
Elongation of inch sections		″.33*, ″.16, ″.11

JACKET.

No. 5301.

Marks, $\frac{6224\ B}{B\ T, M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
10,000	40,000	.001267	.000334	0.	.....	
11,000	44,000	.001400	.000133	0.	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001467	0.	.....	.....	
12,000	48,000	.001533	.000066	.....	.....	
12,250	49,000	.001600	.000067	.....	.....	
12,500	50,000	.001633	.000033	.....	.....	Elastic limit.
12,750	51,000	.001800	.000167	.....	.....	
13,000	52,000	.002800	.001000	.....	.....	
13,250	53,000	.003733	.000933	.....	.....	
13,500	54,000	.004933	.001200	.....	.....	
13,750	55,000	.006033	.001100	.....	.....	
22,940	91,760	.1267	.120667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,760
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1".45 from neck
Character of broken surface		silky
Elongation of inch sections		".13, ".52", ".18

JACKET.

No. 5300 a.

Marks, $\frac{6224\ B_1}{M\ T_1 M}$
Diameter, $''.564$.
Sectional area, .25 square inch.
Gauged length, $3''$.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
11,000	44,000	.001433	.000100	0.	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001500	.000033	.....	.....	
11,750	47,000	.001533	.000033	.....	.....	
12,000	48,000	.001600	.000067	.....	.....	
12,250	49,000	.001667	.000067	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	Elastic limit.
13,000	52,000	.001900	.000167	.....	.....	
13,250	53,000	.002267	.000367	.....	.....	
13,500	54,000	.003333	.001066	.....	.....	
13,750	55,000	.004567	.001234	.....	.....	
14,000	56,000	.006000	.001433	.....	.....	
23,080	92,320	.1300	.1240	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,320
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1".5 from neck
Character of broken surface		silky
Elongation of inch sections		".12, ".34, ".16

JACKET.

No. 5317.

Marks, $\frac{6182\ B}{B\ T, M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
10,000	40,000	.001300	.000367	0.	.....	
11,000	44,000	.001400	.000100	0.	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001467	0.	.....	.....	
12,000	48,000	.001500	.000033	.....	.....	
12,250	49,000	.001567	.000067	.....	.....	
12,500	50,000	.001600	.000033	.....	.....	
12,750	51,000	.001633	.000033	.....	.....	
13,000	52,000	.001700	.000067	.....	.....	
13,250	53,000	.001733	.000033	.....	.....	
13,500	54,000	.001767	.000034	.....	.....	
13,750	55,000	.001800	.000033	.....	.....	
14,000	56,000	.001833	.000033	.....	.....	Elastic limit.
14,250	57,000	.001967	.000134	.....	.....	
14,500	58,000	.002867	.000900	.....	.....	
14,750	59,000	.003700	.000833	.....	.....	
15,000	60,000	.004667	.000967	.....	.....	
15,250	61,000	.005300	.000633	.....	.....	
25,740	102,960	.1200	.1147	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	102,960
Elastic limit per square inch of original section	do...	56,000
Elongation per inch after rupture	inch..	.1800
Elongation per inch under strain at elastic limit	do....	.001833
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		".55 from neck
Character of broken surface		granular, 60 per cent; silky center, 40 per cent
Elongation of inch sections		".28", ".14, ".12

JACKET.

No. 5316.

Marks, $\frac{6182\ B_2}{M\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
10,000	40,000	.001267	.000334	0.	.....	
11,000	44,000	.001400	.000133	0.	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001433	0.	.....	.....	
11,750	47,000	.001467	.000034	.....	.....	
12,000	48,000	.001500	.000033	.....	.....	
12,250	49,000	.001533	.000033	.....	.....	
12,500	50,000	.001567	.000034	.....	.....	
12,750	51,000	.001600	.000033	.....	.....	
13,000	52,000	.001633	.000033	.....	.....	
13,250	53,000	.001667	.000034	.....	.....	Elastic limit.
13,500	54,000	.002033	.000366	.....	.....	
13,750	55,000	.002400	.000367	.....	.....	
14,000	56,000	.002967	.000567	.....	.....	
14,250	57,000	.003600	.000633	.....	.....	
14,500	58,000	.004333	.000733	.....	.....	
24,980	99,920	.1200	.115667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	99,920
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.1800
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1".46 from neck
Character of broken surface		silky; 50 per cent granular
Elongation of inch sections		".10, ".30*, ".14

JACKET.

No. 5347.

Marks, $\frac{5775\ B_2}{B\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000967	.000367	.....	.....	
10,000	40,000	.001300	.000333	0.	.....	
11,000	44,000	.001467	.000167	0.	.....	
11,250	45,000	.001528	.000066	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001633	.000066	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001667	0.	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	Elastic limit.
12,750	51,000	.001833	.000133	.....	.....	
13,000	52,000	.002667	.000834	.....	.....	
13,250	53,000	.003467	.000800	.....	.....	
13,500	54,000	.004667	.001200	.....	.....	
13,750	55,000	.005333	.000666	.....	.....	
23,960	95,840	.1233	.117967	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,840
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.1833
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1".44 from neck
Character of broken surface		silky
Elongation of inch sections		".11, ".31", ".13

JACKET.

No. 5346.

Marks, $\frac{5775\ B_2}{M\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
10,000	40,000	.001367	.000334	0.	.....	
11,000	44,000	.001500	.000133	0.	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001600	.000067	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	Elastic limit.
12,500	50,000	.001833	.000133	.....	.....	
12,750	51,000	.001933	.000100	.....	.....	
13,000	52,000	.002333	.000400	.....	.....	
13,250	53,000	.002833	.000500	.....	.....	
13,500	54,000	.003833	.001000	.....	.....	
23,980	95,920	.1267	.122867	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,920
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.1933
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1".16 from neck
Character of broken surface		silky; 20 per cent of surface interspersed with fine granulation
Elongation of inch sections		".11, ".22, ".25*

TABULATION OF TENSION SPECIMENS FROM 8-INCH STEEL B. L. RIFLES (STEMS 5" LONG, ".564 DIAMETER).

Number of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds.	*Pounds.*	*P. ct.*	*P. ct.*		
5230	Tube	Middle.	46,000	83,840	24.0	52.2	Silky	Breech end.
5229	.....do	...do ...	50,000	87,920	19.7	52.2	.....do	Muzzle end.
5287	.....do	...do ...	49,000	85,680	20.7	47.2	.....do	Breech end.
5286	.....do	...do ...	50,000	83,640	24.7	52.2	Fine, silky.....	Muzzle end.
5296	.....do	...do ...	45,000	86,880	19.3	49.7	Silky	Breech end.
5295	.....do	...do ...	48,000	85,600	23.0	52.2	.....do	Muzzle end.
5313	.....do	...do ...	49,000	89,840	20.3	49.7	.....do	Breech end.
5312	.....do	...do ...	51,000	92,840	19.3	52.2	.....do	Muzzle end.
5343	.....do	...do ...	47,000	84,080	23.7	54.6	Fine, silky.....	Breech end.
5342	.....do	...do ...	51,000	87,760	20.3	44.6	Silky	Muzzle end.
5238	Jacket.....	...do ...	50,000	90,200	21.0	52.2	.....do	Breech end.
5237	.....do	...do ...	51,000	91,040	21.7	52.2	.....do	Muzzle end.
5292	.....do	...do ...	51,000	94,840	18.3	47.2	.....do	Breech end.
5291	.....do	...do ...	49,000	94,080	20.0	47.2	Fine, silky.....	Muzzle end.
5301	.....do	...do ...	50,000	91,760	21.0	47.2	Silky	Breech end.
5300a	.....do	...do ...	51,000	92,320	20.7	44.6	.....do	Muzzle end.
5317	.....do	...do ...	56,000	102,960	18.0	39.2	Granular, 60 per cent; silky, 40 per cent.	Breech end.
5316	.....do	...do ..	53,000	99,920	18.0	41.9	Silky; 50 per cent granular.	Muzzle end.
5347	.....do	...do ...	50,000	95,840	18.3	44.6	Silky	Breech end.
5346	.....do	...do ...	49,000	95,920	19.3	41.9	Silky; 20 per cent of surface interspersed with fine granulation.	Muzzle end.

10-INCH STEEL B. L. RIFLES.

SPECIMENS FROM TUBES AND JACKETS.

TUBE.

No. 5232.

Marks, $\frac{5739\ B_1}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	.....	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	.....	.....	
10,000	40,000	.001333	.000166	.....	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001600	.000100	.....	.....	
11,500	46,000	.001667	.000067	.....	.....	
11,750	47,000	.001700	.000033	.....	.....	Elastic limit.
12,000	48,000	.001933	.000233	.....	.....	
12,250	49,000	.002433	.000500	.....	.....	
12,500	50,000	.003500	.001067	.....	.....	
12,750	51,000	.004333	.000833	.....	.....	
13,000	52,000	.005333	.001000	.....	.....	
22,690	90,760	.1333	.127967	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,760
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.08 from neck
Character of broken surface		silky
Elongation of inch sections		″.33*, ″.17, ″.10

TUBE.

No. 5231.

Marks, $\frac{5739\ B_1}{M\ T_1 M}$
Diameter, $\frac{7}{8}$".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	.....	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	.....	.....	
10,000	40,000	.001333	.000166	.....	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001567	.000067	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001667	0.	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	
13,000	52,000	.001800	.000067	.....	.....	Elastic limit.
13,250	53,000	.001900	.000100	.....	.....	
13,500	54,000	.002500	.000600	.....	.....	
13,750	55,000	.004333	.001833	.....	.....	
14,000	56,000	.005667	.001334	.....	.....	
14,250	57,000	.006667	.001000	.....	.....	
23,510	94,040	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	94,040
Elastic limit per square inch of original section	.do...	52,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do....	.001800
Reduction in diameter at point of rupture	do....	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		".10, ".37', ".13

TUBE.

No. 5241.

Marks, $\frac{5615\ B}{B\ T, M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001500	.000033	.....	.....	
11,750	47,000	.001567	.000067	.....	.....	
12,000	48,000	.001600	.000033	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	Elastic limit.
12,500	50,000	.001800	.000167	.....	.....	
12,750	51,000	.002000	.000200	.....	.....	
13,000	52,000	.004000	.002000	.....	.....	
13,250	53,000	.005000	.001000	.....	.....	
13,500	54,000	.006000	.001000	.....	.....	
23,520	94,080	.1233	.1173	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	94,080
Elastic limit per square inch of original section	do	49,000
Elongation per inch after rupture	inch	.2000
Elongation per inch under strain at elastic limit	do	.001633
Reduction in diameter at point of rupture	do	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		at middle of stem
Character of broken surface		silky, 50 per cent; granular, 50 per cent
Elongation of inch sections		".13, ".32", ".15

TUBE.

No. 5240.

Marks, $\frac{5615\ B_1}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001333	.000133	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001600	.000007	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	
12,500	50,000	.001733	.000033	.....	.....	Elastic limit.
12,750	51,000	.001867	.000134	.....	.....	
13,000	52,000	.002233	.000366	.....	.....	
13,250	53,000	.002833	.000600	.....	.....	
13,500	54,000	.004667	.001834	.....	.....	
13,750	55,000	.006000	.001333	.....	.....	
23,080	92,320	.1267	.1207	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,320
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2033
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1.28 from neck
Character of broken surface		silky
Elongation of inch sections		″.28*, ″.21*, ″.12

TUBE.

No. 5280.

Marks, $\frac{4665\ B}{B\ T_2 M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	Elastic limit.
11,500	46,000	.001967	.000434	.....	.....	
11,750	47,000	.002667	.000700	.....	.....	
12,000	48,000	.004167	.001500	.....	.....	
12,250	49,000	.004800	.000633	.....	.....	
12,500	50,000	.006000	.001200	.....	.....	
22,420	89,680	.1333	.1273	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,680
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1".08 from neck
Character of broken surface		silky
Elongation of inch sections		".12, ".18, ".32*

TUBE.

No. 5279.

Marks, $\frac{4665\ B_1}{M\ T_1\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001433	.000066	.....	.....	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001500	.000033	.....	.....	Elastic limit.
11,250	45,000	.001600	.000100	.....	.....	
11,500	46,000	.001700	.000100	.....	.....	
11,750	47,000	.001767	.000467	.....	.....	
12,000	48,000	.002733	.000566	.....	.....	
12,250	49,000	.003667	.000934	.....	.....	
23,440	93,760	.1233	.119633	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	93.760
Elastic limit per square inch of original section	do...	44.000
Elongation per inch after rupture	inch..	.1467
Elongation per inch under strain at elastic limit	do...	.001500
Reduction in diameter at point of rupture	do...	.074
Reduction in area after rupture, per cent of original section		24.6
Position of rupture		″.8 from neck
Character of broken surface	granular, 95 per cent; dull silky section, 5 per cent	
Elongation of inch sections		″.23*, ″.11, ″.10

JACKET.

No. 5222.

Marks, $\frac{5362\ B}{B\ T_2\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001200	.000200	.000033	.000033	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001400	.000033	.000033	0.	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001567	.000067	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	
12,500	50,000	.001733	.000033	.....	.....	Elastic limit.
12,750	51,000	.001967	.002234	.....	.....	
13,000	52,000	.004667	.002700	.....	.....	
13,250	53,000	.005333	.000666	.....	.....	
13,500	54,000	.006333	.001000	.....	.....	
13,750	55,000	.007000	.000667	.....	.....	
23,610	94,440	.1767	.1697	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	94,440
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.1767
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.135
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.5 from neck
Character of broken surface		silky, trace of granulation
Elongation of inch sections		″.11, ″.29*, ″.13

JACKET.

No. 3221.

Marks, $\frac{5362\ B,}{M\ T,\ M}$
Diameter, ".565.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001333	.000133	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001467	.000067	.....	.....	
11,000	44,000	.001500	.000033	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	Elastic limit.
12,750	51,000	.001867	.000167	.....	.....	
13,000	52,000	.003333	.001466	.....	.....	
13,250	53,000	.004333	.001000	.....	.....	
13,500	54,000	.006000	.001667	.....	.....	
13,750	55,000	.007000	.001000	.....	.....	
23,190	92,760	.1207	.1197	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section ..... pounds.. 92,760
Elastic limit per square inch of original section ..... do... 50,000
Elongation per inch after rupture ..... inch.. .1900
Elongation per inch under strain at elastic limit ..... do... .001700
Reduction in diameter at point of rupture ..... do... .165
Reduction in area after rupture, per cent of original section 49.7
Position of rupture ..... 1".3 from neck
Character of broken surface ..... silky; opened cracks in surface of stem in the vicinity of the place of rupture.
Elongation of inch sections ..... ".10, ".28*, ".19

JACKET.

No. 5224.

Marks, $\frac{5618\ B_1}{B\ T,\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001433	.000066	.000033	.000033	
10,750	43,000	.001500	.000067	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001600	.000067	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001700	.000033	.....	.....	Elastic limit.
12,250	49,000	.002767	.001067	.....	.....	
12,500	50,000	.004000	.001233	.....	.....	
12,750	51,000	.005000	.001000	.....	.....	
13,000	52,000	.006333	.001333	.....	.....	
13,250	53,000	.007000	.000667	.....	.....	
22,770	91,080	.1100	.1030	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,080
Elastic limit per square inch of original section	do....	48,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do....	.001700
Reduction in diameter at point of rupture	do....	.135
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.36 from neck
Character of broken surface		silky
Elongation of inch sections		″.18, ″.20*, ″.12

JACKET.

No. 5223.

Marks, $\frac{5618\ B_1}{MT,\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000367	.000234	.....	.....	
5,000	20,000	.000700	.000333	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
8,750	35,000	.001233	.000166	0.	.....	
10,000	40,000	.001400	.000167	.....	.....	
10,500	42,000	.001467	.000067	0.	.....	
10,750	43,000	.001533	.000066	.....	.....	
11,000	44,000	.001567	.000034	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001633	0.	.....	.....	
12,000	48,000	.001700	.000067	.....	.....	Elastic limit.
12,250	49,000	.001867	.000167	.....	.....	
12,500	50,000	.002267	.000400	.....	.....	
12,750	51,000	.003100	.000833	.....	.....	
13,000	52,000	.005667	.002567	.....	.....	
13,250	53,000	.007167	.001500	.....	.....	
22,740	90,960	.1167	.109533	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,960
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.1900
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1″.55 from neck
Character of broken surface		granular, 55 per cent; silky, 45 per cent
Elongation of inch sections		″.12, ″.32, ″.13

JACKET.

No. 5262.

Marks, $\frac{5791\ B}{B\ T,\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001167	.000200	0.	.....	
10,000	40,000	.001333	.000166	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001467	.000067	.....	.....	
11,000	44,000	.001500	.000033	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001667	.000067	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	
12,500	50,000	.001767	.000067	.....	.....	
12,750	51,000	.001833	.000066	.....	.....	Elastic limit.
13,000	52,000	.003400	.001567	.....	.....	
13,250	53,000	.006133	.002733	.....	.....	
13,500	54,000	.008000	.001867	.....	.....	
13,750	55,000	.008833	.000833	.....	.....	
14,000	56,000	.009667	.000834	.....	.....	
23,310	93,240	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	93,240
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.1900
Elongation per inch under strain at elastic limit	do...	.001833
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		at middle of stem
Character of broken surface		silky, interspersed with granular metal
Elongation of inch section		".13, ".32*, ".12

JACKET.

No. 5261.

Marks, $\frac{5791\ B}{M\ T,M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	
11,750	47,000	.001600	.000067	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	
13,000	52,000	.001767	.000034	.....	.....	
13,250	53,000	.001800	.000033	.....	.....	Elastic limit.
13,500	54,000	.006100	.004300	.....	.....	
13,750	55,000	.006667	.000567	.....	.....	
14,000	56,000	.007533	.000866	.....	.....	
14,250	57,000	.008333	.000800	.....	.....	
14,500	58,000	.009333	.001000	.....	.....	
23,350	93,400	.1200	.110667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	93,400
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.1967
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		".71, ".37", ".12

JACKET.

No. 5282.

Marks, $\frac{5816\ B}{B\ T, M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001367	.000200	.....	.....	
10,500	42,000	.001433	.000066	.000033	.000033	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001533	.000066	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001733	.000066	.....	.....	Elastic limit.
12,500	50,000	.001867	.000134	.....	.....	
12,750	51,000	.002033	.000166	.....	.....	
13,000	52,000	.003333	.001300	.....	.....	
13,250	53,000	.004667	.001334	.....	.....	
13,500	54,000	.006000	.001333	.....	.....	
23,240	92,960	.1200	.1240	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,960
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2123
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1" from neck
Character of broken surface		silky, oblique
Elongation of inch sections		".32, ".31, ".11

JACKET.

No. 5281.

Marks, $\frac{5816\ B}{M\ T,\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001500	.000067	.....	.....	
11,500	46,000	.001567	.000067	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	Elastic limit.
13,000	52,000	.001833	.000100	.....	.....	
13,250	53,000	.002000	.000167	.....	.....	
13,500	54,000	.004333	.002333	.....	.....	
13,750	55,000	.005333	.001000	.....	.....	
14,000	56,000	.006677	.001334	.....	.....	
23,030	92,120	.1300	.123333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,120
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.2200
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1″.6 from neck
Character of broken surface		fine, silky
Elongation of inch sections		″.12, ″.40*, ″.14

JACKET.

No. 5324.

Marks, $\frac{5901\ B}{B\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000933	.000300	.....	.....	
8,750	35,000	.001100	.000167	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001500	.000033	.....	.....	
11,750	47,000	.001533	.000033	.....	.....	
12,000	48,000	.001600	.000067	.....	.....	
12,250	49,000	.001667	.000067	.....	.....	Elastic limit.
12,500	50,000	.003367	.001700	.....	.....	
12,750	51,000	.004000	.000633	.....	.....	
13,000	52,000	.005000	.001000	.....	.....	
13,250	53,000	.005500	.000500	.....	.....	
13,500	54,000	.006667	.001167	.....	.....	
23,280	93,120	.1267	.120033	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	93,120
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.1933
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1".22 from nock
Character of broken surface		silky, 60 per cent; granular, 40 per cent
Elongation of inch sections		".21, ".26*, ".11

JACKET.

No. 5323.

Marks, $\frac{5691\ B_1}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001333	.000033	0.	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001500	.000033	.....	.....	
12,000	48,000	.001533	.000033	.....	.....	
12,250	49,000	.001567	.000034	.....	.....	
12,500	50,000	.001633	.000066	.....	.....	
12,750	51,000	.001667	.000034	.....	.....	
13,000	52,000	.001700	.000033	.....	.....	
13,250	53,000	.001733	.000033	.....	.....	
13,500	54,000	.001767	.000034	.....	.....	
13,750	55,000	.001767	0.	.....	.....	Elastic limit.
14,000	56,000	.001933	.000166	.....	.....	
14,250	57,000	.003600	.001667	.....	.....	
14,500	58,000	.004667	.001067	.....	.....	
14,750	59,000	.005667	.001000	.....	.....	
15,000	60,000	.007000	.001333	.....	.....	
24,120	96,480	.1233	.1163	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	96,480
Elastic limit per square inch of original section	do...	55,000
Elongation per inch after rupture	inch..	.1833
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.5 from neck
Character of broken surface		silky
Elongation of inch sections		″.12, ″.33*, ″.10

JACKET.

No. 5359.

Marks, $\frac{10\ R_{IP}\ J}{B\ T,\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001100	.000167	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001333	.000033	0.	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001400	0.	.....	.....	
11,500	46,000	.001433	.000033	.....	.....	
11,750	47,000	.001467	.000034	.....	.....	
12,000	48,000	.001500	.000033	.....	.....	
12,250	49,000	.001533	.000033	.....	.....	
12,500	50,000	.001600	.000067	.....	.....	
12,750	51,000	.001667	.000067	.....	.....	
13,000	52,000	.001733	.000066	.....	.....	
13,250	53,000	.001767	.000034	.....	.....	Elastic limit.
13,500	54,000	.001967	.000200	.....	.....	
13,750	55,000	.002433	.000466	.....	.....	
14,000	56,000	.003333	.000900	.....	.....	
14,250	57,000	.003967	.000634	.....	.....	
14,500	58,000	.005000	.001033	.....	.....	
24,670	98,680	.1233	.1183	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	98,680
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.1967
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		″.08 from neck
Character of broken surface		silky, trace of granulation
Elongation of inch sections		″.30*, ″.19, ″.10

JACKET.

No. 5360.

Marks, $\frac{10\ R_{10}\ J}{M\ T,\ O}$
Diameter, ″.564.
Sectional area, 25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Sucessive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	
11,750	47,000	.001567	.000066	.....	.....	
12,000	48,000	.001633	.000066	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001700	0.	.....	.....	
13,000	52,000	.001733	.000033	.....	.....	Elastic limit.
13,250	53,000	.001867	.000134	.....	.....	
13,500	54,000	.003667	.001800	.....	.....	
13,750	55,000	.004667	.001000	.....	.....	
14,000	56,000	.006333	.001666	.....	.....	
14,250	57,000	.007333	.001000	.....	.....	
22,240	88,960	.1267	.119367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,960
Elastic limit per square inch of original section	do...	52,000
Elongation per inch after ruptnre	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.64 from neck
Character of broken surface		silky
Elongation of inch sections		″.15, ″.36*, ″.11

TABULATION OF TENSION SPECIMENS FROM 10-INCH STEEL B. L. RIFLES (STEMS 5" LONG, ".564 DIAMETER).

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds.	*Pounds.*	*P. ct.*	*P. ct.*		
5232	Tube	Middle	47,000	90,760	20.0	44.6	Silky	Breech end.
5231	do	do	52,000	94,040	20.0	49.7	do	Muzzle end.
5241	do	do	49,000	94,080	20.0	33.5	Silky, 50 per cent; granular, 50 per cent.	Breech end.
5240	do	do	50,000	92,320	20.3	47.2	Silky	Muzzle end.
5280	do	do	45,000	89,680	20.7	39.2	do	Breech end.
5279	do	do	44,000	93,760	14.7	24.6	Granular, 50 per cent; dull silky, 50 per cent.	Muzzle end.
5222	Jacket	do	50,000	94,440	17.7	41.9	Silky; trace of granulation.	Breech end.
5221	do	do	50,000	92,760	19.0	49.7	Silky	Muzzle end.
5224	do	do	48,000	91,080	20.0	41.9	do	Breech end.
5223	do	do	48,000	90,960	19.0	39.2	Granular, 55 per cent; silky, 45 per cent.	Muzzle end.
5262	do	do	51,000	93,240	19.0	39.0	Silky and granular metal interspersed.	Breech end.
5261	do	do	53,000	93,400	19.7	49.7	Silky	Muzzle end.
5282	do	do	49,000	92,960	21.3	47.2	Silky; oblique	Breech end.
5281	do	do	51,000	92,120	22.0	52.2	Fine silky	Muzzle end.
5324	do	do	49,000	93,120	19.3	39.2	Silky, 60 per cent; granular, 40 per cent.	Breech end.
5323	do	do	55,000	96,480	18.3	44.6	Silky	Muzzle end.
5359	Jacket No. 19	Outside	53,000	96,080	19.7	41.9	Silky; trace of granulation.	Breech end.
5360	do	do	52,000	88,960	20.7	47.2	Silky	Muzzle end.

12-INCH STEEL B. L. RIFLES.

SPECIMENS FROM TUBES AND JACKETS.

TUBE.

No. 5226.

Marks, $\frac{5268\ B}{B\ T,\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000167	.000167	0.	.....	
2,500	10,000	.000333	.000166	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001467	.000067	.....	.....	
11,000	44,000	.001567	.000100	.....	.....	
11,250	45,000	.001633	.000066	.....	.....	
11,500	46,000	.001700	.000067	.....	.....	
11,750	47,000	.001767	.000067	.....	.....	Elastic limit.
12,000	48,000	.002000	.000233	.....	.....	
12,250	49,000	.002267	.000267	.....	.....	
12,500	50,000	.002667	.000400	.....	.....	
12,750	51,000	.003100	.000433	.....	.....	
13,000	52,000	.004067	.000967	.....	.....	
23,500	94,000	.1333	.129233	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	94,000
Elastic limit per square inch of original section	do ..	47,000
Elongation per inch after rupture	inch..	.1900
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of ruptnre		1".75 from neck
Character of broken surface		granular, 60 per cent; dull silky, 40 per cent
Elongation of inch sections		".13, ".31*, ".13

TUBE.

No. 5227.

Marks, $\frac{5268\ B_1}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000033	.000033	0.	.....	
2,500	10,000	.000267	.000234	.....	.....	
5,000	20,000	.000567	.000300	.....	.....	
7,500	30,000	.000900	.000333	.....	.....	
8,750	35,000	.001033	.000133	0.	.....	
10,000	40,000	.001300	.000267	0.	.....	
10,250	41,000	.001300	0.	.....	.....	
10,500	42,000	.001333	.000033	.....	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001500	.000067	.....	.....	Elastic limit.
11,750	47,000	.002000	.000500	.....	.....	
12,000	48,000	.008667	.006667	.....	.....	
12,250	49,000	.009267	.000600	.....	.....	
12,500	50,000	.010067	.000800	.....	.....	
12,750	51,000	.010967	.000900	.....	.....	
21,900	87,600	.1367	.125733	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,600
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.2200
Elongation per inch under strain at elastic limit	do....	.001500
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.53 from neck
Character of broken surface		silky
Elongation of inch sections		″.14, ″.36, ″.16

TUBE.

No. 5236.

Marks, $\frac{5330\ B_1}{B\ T,\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001467	.000067	.....	.....	
11,250	45,000	.001500	.000033	.....	.....	
11,500	46,000	.001567	.000067	.....	.....	
11,750	47,000	.001633	.000066	.....	.....	Elastic limit.
12,000	48,000	.002300	.000667	.....	.....	
12,250	49,000	.003367	.001067	.....	.....	
12,500	50,000	.004600	.001233	.....	.....	
12,750	51,000	.005267	.000667	.....	.....	
13,000	52,000	.006100	.000833	.....	.....	
22,870	91,480	.1267	.1206	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,480
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.1967
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		".13, ".34*, ".12

TUBE.

No. 5235.

Marks, $\frac{5330\ B_1}{M\ T_1\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000933	.000300	.....	.....	
8,750	35,000	.001100	.000167	0.	.....	
10,000	40,000	.001300	.000200	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	Elastic limit.
		.006000	.004533	.....	.....	
11,500	46,000	.007667	.001667	.....	.....	
11,750	47,000	.008533	.000866	.....	.....	
12,000	48,000	.009167	.000634	.....	.....	
12,250	49,000	.009833	.000666	.....	.....	
12,500	50,000	.011333	.001500	.....	.....	
21,200	84,800	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	84,800
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.001467
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1".37 from neck
Character of broken surface		*silky*
Elongation of inch sections		".22, ".33*, ".14

TUBE.

No. 5283.

Marks, $\frac{12\ R,\ T}{B\ T,\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001333	.000133	.000033	.000033	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001500	.000033	.....	.....	
11,500	46,000	.001533	.000033	.....	.....	
11,750	47,000	.001600	.000067	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	Elastic limit.
12,500	50,000	.001767	.000100	.....	.....	
		.002067	.000300	.....	.....	
12,750	51,000	.002667	.000600	.....	.....	
12,000	52,000	.003667	.001000	.....	.....	
13,250	53,000	.004667	.001000	.....	.....	
13,500	54,000	.006000	.001333	.....	.....	
23,080	92,320	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,320
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.1900
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		1″.39 from neck
Character of broken surface		silky serrated, 60 per cent; granular, 40 per cent
Elongation of inch sections		″.10, ″.29*, ″.18

TUBE.

No. 5284.

Marks, $\frac{12\ R,\ T}{M\ T,\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001400	.0	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	Elastic limit.
11,500	46,000	.004333	.002900	.....	.....	
11,750	47,000	.016000	.011667	.....	.....	
12,000	48,000	.016833	.000833	.....	.....	
12,250	49,000	.018000	.001167	.....	.....	
12,500	50,000	.020000	.002000	.....	.....	
18,890	75,560	.1800	.1600	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	75,560
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2967
Elongation per inch under strain at elastic limit	do...	.001433
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section	do...	52.2
Position of rupture		1″.4 from neck
Character of broken surface		fine, silky
Elongation of inch sections		″.21, ″.45*, ″.23

TUBE.

No. 5305.

Marks, $\frac{12\ R_1\ T}{B\ T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001100	.000167	0.	.....	
10,000	40,000	.001233	.000133	0.	.....	
10,250	41,000	.001233	0.	.....	.....	
10,500	42,000	.001267	.000034	.....	.....	
10,750	43,000	.001300	.000033	.....	.....	
11,000	44,000	.001333	.000033	.....	.....	
11,250	45,000	.001367	.000034	.....	.....	
11,500	46,000	.001400	.000033	.....	.....	
11,750	47,000	.001433	.000033	.....	.....	
12,000	48,000	.001467	.000034	.....	.....	Elastic limit.
12,250	49,000	.002900	.001433	.....	.....	
12,500	50,000	.005800	.002900	.....	.....	
12,750	51,000	.006667	.000867	.....	.....	
13,000	52,000	.008000	.001333	.....	.....	
13,250	53,000	.008800	.000800	.....	.....	
21,520	86,080	.1533	.1445	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,080
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.1567
Elongation per inch under strain at elastic limit	do...	.001467
Reduction in diameter at point of rupture	do...	.064
Reduction in area after rupture, per cent of original section		21.4
Position of rupture		1″.2 from neck
Character of broken surface		granular, radiating from a small flaky spot in the circumference
Elongation of inch sections		″.13, ″.19*, ″.15

TUBE.

No. 5306.

Marks, $\frac{12\ R.\ T}{M\ T.\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000900	.000300	.....	.....	
8,750	35,000	.001067	.000167	0.	.....	
10,000	40,000	.001233	.000166	.....	.....	
10,250	41,000	.001267	.000034	.....	.....	
10,500	42,000	.001267	0.	.....	.....	
10,750	43,000	.001300	.000033	.....	.....	
11,000	44,000	.001333	.000033	.....	.....	Elastic limit.
11,250	45,000	.003667	.002334	.....	.....	
11,500	46,000	.005400	.001733	.....	.....	
11,750	47,000	.006667	.001267	.....	.....	
12,000	48,000	.008667	.002000	.....	.....	
12,250	49,000	.010667	.002000	.....	.....	
20,220	80,880	.1500	.139333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	80,880
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001333
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		″.85 from neck
Character of broken surface		silky
Elongation of inch sections		″.11, ″.16, ″.41*

TUBE.

No. 5325.

Marks, $\frac{12\ R.\ T}{B\ T.\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000633	.000366	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001267	.000134	0.	.....	
10,250	41,000	.001300	.000033	.....	.....	
10,500	42,000	.001333	.000033	.....	.....	
10,750	43,000	.001333	0.	.....	.....	
11,000	44,000	.001367	.000034	.....	.....	
11,250	45,000	.001400	.000033	.....	.....	
11,500	46,000	.001433	.000033	.....	.....	
11,750	47,000	.001500	.000067	.....	.....	Elastic limit.
12,000	48,000	.001667	.000167	.....	.....	
12,250	49,000	.002067	.000400	.....	.....	
12,500	50,000	.005000	.002933	.....	.....	
12,750	51,000	.005667	.000667	.....	.....	
13,000	52,000	.007033	.001366	.....	.....	
21,520	86,080	.1467	.139667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,080
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001500
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.14 from neck
Character of broken surface		silky
Elongation of inch sections		″.13, ″.23, ″.32*

TUBE.

No. 5326.

Marks, $\frac{12\ R_s\ T}{M\ T,\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001100	.000167	0.	.....	
10,000	40,000	.001267	.000167	0.	.....	
10,250	41,000	.001300	.000033	.....	.....	
10,500	42,000	.001333	.000033	.....	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001500	.000067	.....	.....	
11,750	47,000	.001533	.000033	.....	.....	
12,000	48,000	.001600	.000067	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	Elastic limit.
12,500	50,000	.008000	.006367	.....	.....	
12,750	51,000	.008633	.000633	.....	.....	
13,000	52,000	.009400	.000767	.....	.....	
13,250	53,000	.010667	.001267	.....	.....	
13,500	54,000	.012000	.001333	.....	.....	
20,420	81,680	.1600	.1480	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	81,680
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2433
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.7 from neck
Character of broken surface		silky
Elongation of inch sections		″.14, ″.42, ″.17

TUBE.

No. 5352.

Marks, $\frac{0065\ B}{B\ T, M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001433	.000233	.000067	.000067	
10,250	41,000	.001500	.000067	.....	.....	
10,500	42,000	.001567	.000067	.....	.....	
10,750	43,000	.001600	.000033	.....	.....	Elastic limit.
11,000	44,000	.001933	.000333	.....	.....	
11,250	45,000	.002200	.000267	.....	.....	
11,500	46,000	.002633	.000433	.....	.....	
11,750	47,000	.002967	.000334	.....	.....	
12,000	48,000	.003667	.000700	.....	.....	
22,450	89,800	.1333	.129633	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,800
Elastic limit per square inch of original section	do...	43,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per centum of original section		44.6
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		".14, ".35*, ".14

TUBE.

No. 5351.

Marks, $\frac{6085\ B,}{M\ T,\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000333	.000266	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001367	.000167	0.	.....	
10,250	41,000	.001400	.000033	.....	.....	
10,500	42,000	.001433	.000033	.....	.....	
10,750	43,000	.001500	.000067	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	Elastic limit.
11,500	46,000	.004333	.002766	.....	.....	
11,750	47,000	.004767	.000434	.....	.....	
12,000	48,000	.005633	.000866	.....	.....	
12,250	49,000	.006333	.000700	.....	.....	
12,500	50,000	.007367	.001034	.....	.....	
22,770	91,080	.1367	.129333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds...	91,080
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.001567
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.7 from neck
Character of broken surface		silky
Elongation of inch sections		.″17, ″.38*, ″.14

JACKET.

No. 5245.

Marks, $\frac{5532\ B_1}{B\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	
11,750	47,000	.001600	.000067	.....	.....	Elastic limit.
12,000	48,000	.003333	.001733	.....	.....	
12,250	49,000	.004333	.001000	.....	.....	
12,500	50,000	.005333	.001000	.....	.....	
12,750	51,000	.006167	.000834	.....	.....	
13,000	52,000	.006833	.000666	.....	.....	
23,460	93,840	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	93,840
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.1800
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		1". 7 from neck
Character of broken surface		granular, 60 per cent; silky, 40 per cent
Elongation of inch sections		".12, ".30*, ".12

JACKET.

No. 5244.

Marks, $\frac{5532\ B_1}{M\ T, M}$
Diameter, $''.564$.
Sectional area, .25 square inch.
Gauged length, $3''$.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001133	.000200	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001500	.000067	.....	.....	Elastic limit.
11,500	46,000	.002000	.000500	.....	.....	
		.004333	.002333	.....	.....	
11,750	47,000	.005100	.000767	.....	.....	
12,000	48,000	.006000	.000900	.....	.....	
12,250	49,000	.006833	.000833	.....	.....	
12,500	50,000	.007667	.000834	.....	.....	
22,510	90,040	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	90,040
Elastic limit per square inch of original section	do	45,000
Elongation per inch after rupture	inch	.2067
Elongation per inch under strain at elastic limit	do	.001500
Reduction in diameter at point of rupture	do	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		$1''.54$ from neck
Character of broken surface		silky
Elongation of inch sections		$''.15$, $''.34$*, $''.13$

JACKET.

No. 5274.

Marks, $\frac{5820\ B_1}{B\ T,\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001433	.000066	.000083	.000033	
10,750	43,000	.001500	.000067	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	Elastic limit.
11,250	45,000	.002000	.000467	.....	.....	
11,500	46,000	.002833	.000833	.....	.....	
11,750	47,000	.003900	.001067	.....	.....	
12,000	48,000	.004600	.000700	.....	.....	
12,250	49,000	.005367	.000767	.....	.....	
22,940	91,760	.1400	.134633	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,760
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1".27 from neck
Character of broken surface		silky
Elongation of inch sections		".14, ".35*, ".14

JACKET.

No. 5273.

Marks, $\frac{5830\ B_1}{M\ T_8\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001538	.000066	.....	.....	
11,750	47,000	.001567	.000034	.....	.....	Elastic limit.
12,000	48,000	.002233	.000666	.....	.....	
12,250	49,000	.002700	.000467	.....	.....	
12,500	50,000	.004667	.001967	.....	.....	
12,750	51,000	.005700	.001033	.....	.....	
13,000	52,000	.006667	.000967	.....	.....	
23,080	92,320	.1367	.130033	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,320
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2133
Elongation per inch under strain at elastic limit	do...	.001567
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″ from nock
Character of broken surface		silky
Elongation of inch sections		″.14, ″.17, ″.33*

JACKET.

No. 5289.

Marks, $\frac{5866\ B}{B\ T, M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	.000033	.000033	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001433	.000066	.000067	.000034	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001533	.000066	.....	.....	
11,250	45,000	.001600	.000067	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	Elastic limit.
12,000	48,000	.003500	.001833	.....	.....	
12,250	49,000	.004000	.000500	.....	.....	
12,500	50,000	.004733	.000733	.....	.....	
12,750	51,000	.005333	.000600	.....	.....	
13,000	52,000	.006333	.001000	.....	.....	
23,860	95,440	.1367	.130367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,440
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.1867
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		1".5 from neck
Character of broken surface		granular, 60 per cent; dull silky, 40 per cent
Elongation of inch sections		".14, ".29*, ".13

JACKET.

No. 5288.

Marks, $\frac{5866\ B}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000333	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001400	0.	.....	.....	
11,250	45,000	.001467	.000067	.....	.....	Elastic limit.
11,500	46,000	.003167	.001700	.....	.....	
11,750	47,000	.005000	.001833	.....	.....	
12,000	48,000	.005733	.000733	.....	.....	
12,250	49,000	.006333	.000600	.....	.....	
12,500	50,000	.007700	.001367	.....	.....	
21,920	87,680	.1367	.1290	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,680
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.001467
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture per cent of original section		47.2
Position of rupture		1″.26 from neck
Character of broken surface		silky
Elongation of inch sections		″.12, ″.27, ″.26

JACKET.

No. 5340.

Marks, $\frac{12\ R.\ J}{B\ T.\ O}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001367	0.	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001500	.000033	.....	.....	
12,000	48,000	.001533	.000033	.....	.....	
12,250	49,000	.001567	.000034	.....	.....	
12,500	50,000	.001600	.000033	.....	.....	
12,750	51,000	.001633	.000033	.....	.....	
13,000	52,000	.001700	.000067	.....	.....	
13,250	53,000	.001767	.000067	.....	.....	Elastic limit.
13,500	54,000	.002200	.000433	.....	.....	
13,750	55,000	.002733	.000533	.....	.....	
14,000	56,000	.004000	.001267	.....	.....	
14,250	57,000	.005167	.001167	.....	.....	
14,500	58,000	.006333	.001166	.....	.....	
23,590	94,360	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	94,360
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.2033
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		".27 from neck
Character of broken surface		silky, with trace of granulation
Elongation of inch sections		".27*, ".23*, ".11

JACKET.

No. 5273.

Marks, $\frac{5830\ B}{M\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001538	.000066	.....	.....	
11,750	47,000	.001567	.000034	.....	.....	Elastic limit.
12,000	48,000	.002233	.000666	.....	.....	
12,250	49,000	.002700	.000467	.....	.....	
12,500	50,000	.004667	.001967	.....	.....	
12,750	51,000	.005700	.001033	.....	.....	
13,000	52,000	.006667	.000967	.....	.....	
23,080	92,320	.1367	.130033	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,320
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2133
Elongation per inch under strain at elastic limit	do...	.001567
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1" from neck
Character of broken surface		silky
Elongation of inch sections		".14, ".17, ".33*

JACKET.

No. 5289.

Marks, $\frac{5866\ B_1}{B\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	.000033	.000033	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001433	.000066	.000067	.000034	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001533	.000066	.....	.....	
11,250	45,000	.001600	.000067	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	Elastic limit.
12,000	48,000	.003500	.001833	.....	.....	
12,250	49,000	.004000	.000500	.....	.....	
12,500	50,000	.004733	.000733	.....	.....	
12,750	51,000	.005333	.000600	.....	.....	
13,000	52,000	.006333	.001000	.....	.....	
23,880	95,440	.1367	.130367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,440
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.1867
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		1".5 from neck
Character of broken surface		granular, 60 per cent; dull silky, 40 per cent
Elongation of inch sections		".14, ".29*, ".13

JACKET.

No. 5288.

Marks, $\frac{5866\ B_1}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000333	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001400	0.	.....	.....	
11,250	45,000	.001467	.000067	.....	.....	Elastic limit.
11,500	46,000	.003167	.001700	.....	.....	
11,750	47,000	.005000	.001833	.....	.....	
12,000	48,000	.005733	.000733	.....	.....	
12,250	49,000	.006333	.000600	.....	.....	
12,500	50,000	.007700	.001367	.....	.....	
21,920	87,680	.1367	.1290	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,680
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.001467
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture per cent of original section		47.2
Position of rupture		1″.26 from neck
Character of broken surface		silky
Elongation of inch sections		″.12, ″.27, ″.26

JACKET.

No. 5340.

Marks, $\frac{12\ R,J}{B\ T,O}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001367	0.	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001500	.000033	.....	.....	
12,000	48,000	.001533	.000033	.....	.....	
12,250	49,000	.001567	.000034	.....	.....	
12,500	50,000	.001600	.000033	.....	.....	
12,750	51,000	.001633	.000033	.....	.....	
13,000	52,000	.001700	.000067	.....	.....	
13,250	53,000	.001767	.000067	.....	.....	Elastic limit.
13,500	54,000	.002200	.000433	.....	.....	
13,750	55,000	.002733	.000533	.....	.....	
14,000	56,000	.004000	.001267	.....	.....	
14,250	57,000	.005167	.001167	.....	.....	
14,500	58,000	.006333	.001166	.....	.....	
23,590	94,360	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	94,360
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.2033
Elongation per inch under strain at elastic limit	do....	.001767
Reduction in diameter at point of rupture	do....	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		".27 from neck
Character of broken surface		silky, with trace of granulation
Elongation of inch sections		".27*, ".23*, ".11

JACKET.

No. 5341.

Marks, $\frac{12\ R.\ J}{M\ T.\ O}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001333	.000033	0.	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001500	.000033	.....	.....	
12,000	48,000	.001533	.000033	.....	.....	
12,250	49,000	.001567	.000034	.....	.....	
12,500	50,000	.001633	.000066	.....	.....	
12,750	51,000	.001667	.000034	.....	.....	Elastic limit.
13,000	52,000	.002833	.001166	.....	.....	
13,250	53,000	.004967	.002134	.....	.....	
13,500	54,000	.006200	.001233	.....	.....	
13,750	55,000	.007000	.000800	.....	.....	
14,000	56,000	.008933	.001933	.....	.....	
21,910	87,640	.1333	.124367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,640
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		".30 from neck
Character of broken surface		silky
Elongation of inch sections		".12, ".27*, ".30*

JACKET.

No. 5354.

Marks, $\frac{6181\ B_1}{M\ T_4\ M}$
Diameter, ".564.
Sectional area .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001333	.000133	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001467	.000067	.....	.....	
11,000	44,000	.001500	.000033	.....	.....	
11,250	45,000	.001567	.000067	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001633	0.	.....	.....	Elastic limit.
12,250	49,000	.002633	.001000	.....	.....	
12,500	50,000	.005167	.002534	.....	.....	
12,750	51,000	.005667	.000500	.....	.....	
13,000	52,000	.006267	.000600	.....	.....	
13,250	53,000	.006833	.000566	.....	.....	
23,890	95,560	.1300	.123167	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,560
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.1967
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1".3 from neck
Character of broken surface		silky
Elongation of inch sections		".16, ".26*, ."17

JACKET.

No. 5355.

Marks, $\frac{6181\ B}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001000	.000300	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001400	.000233	.....	.....	
10,500	42,000	.001500	.000100	.000033	.000033	
10,750	43,000	.001533	.000033	.....	.....	
11,000	44,000	.001567	.000034	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	Elastic limit.
11,500	46,000	.001867	.000267	.....	.....	
11,750	47,000	.002067	.000200	.....	.....	
12,000	48,000	.002367	.000300	.....	.....	
12,250	49,000	.003967	.001600	.....	.....	
12,500	50,000	.004667	.000700	.....	.....	
24,260	97,040	.1067	.102033	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	97,040
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.1767
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		1″.67 from neck
Character of broken surface		granular, 60 per cent; silky, 40 per cent
Elongation of inch sections		″.12, ″.28, * ″.13

JACKET.

No. 5357.

Marks, $\frac{12\ R\ 6\ J}{B\ T,\ O}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	
8,750	35,000	.001167	.000134	0.	.....	
10,000	40,000	.001400	.000233	.....	.....	
10,500	42,000	.001467	.000067	.000033	.000033	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001533	0.	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001667	.000067	.....	.....	
12,250	49,000	.001733	.000066	.....	.....	Elastic limit.
12,500	50,000	.001867	.000134	.....	.....	
12,750	51,000	.002133	.000266	.....	.....	
13,000	52,000	.004333	.002200	.....	.....	
13,250	53,000	.005733	.001400	.....	.....	
13,500	54,000	.006967	.001234	.....	.....	
22,860	91,440	.1400	.133033	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,440
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1".47 from neck
Character of broken surface		silky
Elongation of inch sections		".14, ".35*, ".19

JACKET.

No. 5358.

Marks, $\frac{12\ R.\ J}{MT\ ,\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001433	.000066	0.	.....	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001500	.010033	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001733	.000066	.....	.....	Elastic limit.
12,750	51,000	.001833	.000100	.....	.....	
13,000	52,000	.002000	.000167	.....	.....	
13,250	53,000	.002333	.000333	.....	.....	
13,500	54,000	.006000	.003667	.....	.....	
13,750	55,000	.008667	.002667	.....	.....	
22,160	88,640	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,640
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2367
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1″.74 from neck
Character of broken surface		silky
Elongation of inch sections		″.16, ″.42, ″.13

TABULATION OF TENSION SPECIMENS FROM 12-INCH STEEL B. L. RIFLES (STEMS 5" LONG, ".564 DIAMETER).

No. of test.	Position in gun.	Location of specimens.	Elastic limit, per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds.	*Pounds.*	*Per ct.*	*Per ct.*		
5228	Tube	Middle..	47,000	94,000	19.0	39.2	Granular, 60 per cent; dull silky, 40 per cent.	Breech end.
5227	.....do	....do ...	46,000	87,600	22.0	44.6	Silky	Muzzle end.
5236	.....do	....do ...	47,000	91,480	19.7	44.6	.....do	Breech end.
5235	.....do	....do ...	45,000	84,800	23.0	47.2	.....do	Muzzle end.
5283	Tube No. 2..	Outside.	49,000	92,320	19.0	36.4	Silky serrated, 60 per cent; granular, 40 per cent.	Breech end.
5284	.....do	....do ...	45,000	75,560	29.7	52.2	Fine silky	Muzzle end.
5305	Tube No. 4..	....do ...	48,000	86,080	15.7	21.4	Granular, radiating from flaky spot in circumference.	Breech end.
5306	.....do	....do ...	44,000	80,880	22.7	47.2	Silky	Muzzle end.
5325	Tube No. 5..	....do ...	47,000	86,080	22.7	49.7	.....do	Breech end.
5326	.....do	....do ...	49,000	81,680	24.3	49.7	.....do	Muzzle end.
5352	Tube	Middle..	43,000	89,800	21.0	44.6	.....do	Breech end.
5351	.....do	....do ...	45,000	91,080	23.0	44.6	.....do	Muzzle end.
5245	Jacket.....	....do ...	47,000	93,840	18.0	33.5	Granular, 60 per cent; silky, 40 per cent.	Breech end.
5244	.....do	....do ...	45,000	90,040	20.7	44.6	Silky	Muzzle end.
5274	.....do	....do ...	44,000	91,760	21.0	41.9	.....do	Breech end.
5273	.....do	....do ...	47,000	92,320	21.3	44.6	.....do	Muzzle end.
5289	.....do	....do ...	47,000	95,440	18.7	33.5	Granular, 60 per cent; dull silky, 40 per cent.	Breech end.
5288	.....do	....do ...	45,000	87,680	21.7	47.2	Silky	Muzzle end.
5340	Jacket No. 5.	Outside.	53,000	94,360	20.3	44.6	Silky, trace of granulation.	Breech end.
5341	.....do	....do ...	51,000	87,640	23.0	47.2	Silky	Muzzle end.
5354	Jacket.....	Middle..	48,000	95,560	19.7	39.2	.....do	Do.
5355	.....do	....do ...	45,000	97,040	17.7	33.5	Granular, 60 per cent; silky, 40 per cent.	Breech end.
5357	Jacket No. 6.	Outside.	49,000	91,440	22.7	47.2	Silky	Do.
5356	.....do	....do ...	50,000	88,640	23.7	52.2	.....do	Muzzle end.

RIFLE-BARREL STEEL, .30 CALIBER.

No. 5234.

Marks, 12.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	—.000033	—.000033	
10,000	40,000	.001267	.000334	—.000033	0.	
12,500	50,000	.001600	.000333	—.000033	0.	
15,000	60,000	.001967	.000367	0.	.000033	
16,000	64,000	.002033	.000066	.....	.....	Elastic limit.
						Load fell.
14,250	57,000	.003567	.001534	.....	.....	
14,500	58,000	.004167	.000600	.....	.....	
14,750	59,000	.007333	.003166	.....	.....	
15,000	60,000	.011067	.003734	.....	.....	
15,250	61,000	.012200	.001133	.....	.....	
15,500	62,000	.012667	.000467	.....	.....	
16,000	64,000	.014067	.001400	.....	.....	
16,500	66,000	.016167	.002100	.....	.....	
17,000	68,000	.018000	.001833	.....	.....	
17,500	70,000	.020333	.002333	.....	.....	
18,000	72,000	.022333	.002000	.....	.....	
18,500	74,000	.024833	.002500	.....	.....	
19,000	76,000	.027300	.002467	.....	.....	
20,000	80,000	.0300	.0027	.....	.....	
21,000	84,000	.0367	.0067	.....	.....	
22,000	88,000	.0467	.0100	.....	.....	
23,000	92,000	.0567	.0100	.....	.....	
24,000	96,000	.0767	.0200	.....	.....	
25,000	100,000	.1300	.0533	.....	.....	
25,020	100,080	.1433	.0133	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	100,080
Elastic limit per square inch of original section	do...	64,000
Elongation per inch after rupture	inch..	.2233
Elongation per inch under strain at elastic limit	do...	.002033
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		at middle of length
Character of broken surface		fine silky
Elongation of inch sections		".15, ".37*, ".15

For chemical analysis, see page 702.

No. 5225.

Marks, 26.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000200	.000200	0.	.....	
2,500	10,000	.000333	.000133	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	0.	.....	
10,000	40,000	.001333	.000333	.000033	.000033	
11,250	45,000	.001533	.000200	.....	.....	
12,500	50,000	.001667	.000134	.....	.....	
13,750	55,000	.001867	.000200	.....	.....	
14,000	56,000	.001933	.000066	.....	.....	
14,250	57,000	.001933	0.	.....	.....	
14,500	58,000	.001967	.000034	.....	.....	
14,750	59,000	.002000	.000033	.....	.....	Elastic limit.
15,000	60,000	.010233	.000833	.....	.....	
15,250	61,000	.010733	.000500	.....	.....	
15,500	62,000	.011400	.000667	.....	.....	
15,750	63,000	.012167	.000767	.....	.....	
16,000	64,000	.012900	.000733	.....	.....	
16,250	65,000	.013667	.000767	.....	.....	
16,500	66,000	.014333	.000666	.....	.....	
16,750	67,000	.015000	.000667	.....	.....	
17,000	68,000	.016000	.001000	.....	.....	
17,250	69,000	.016867	.000867	.....	.....	
17,500	70,000	.017667	.000800	.....	.....	
18,000	72,000	.019333	.001666	.....	.....	
18,500	74,000	.021333	.002000	.....	.....	
19,000	76,000	.023333	.002000	.....	.....	
19,500	78,000	.025667	.002334	.....	.....	
20,000	80,000	.027667	.002000	.....	.....	
20,500	82,000	.030333	.002666	.....	.....	
21,000	84,000	.032767	.002434	.....	.....	
21,500	86,000	.035833	.003066	.....	.....	
22,000	88,000	.039000	.003167	.....	.....	
22,500	90,000	.042330	.003330	.....	.....	
23,000	92,000	.0467	.004370	.....	.....	
23,500	94,000	.0500	.0033	.....	.....	
24,000	96,000	.0567	.0067	.....	.....	
24,500	98,000	.0633	.0066	.....	.....	
25,000	100,000	.0700	.0067	.....	.....	
25,500	102,000	.0867	.0067	.....	.....	
26,000	104,000	.1067	.0200	.....	.....	
26,100	104,400	.1333	.0266	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	104,400
Elastic limit per square inch of original section	do...	59,000
Elongation per inch after rupture	inch..	.1867
Elongation per inch under strain at elastic limit	do...	.002000
Reduction in diameter at point of rupture	do...	.094
Reduction in area after rupture, per cent of original section		30.6
Position of rupture		1″.20 from neck
Character of broken surface		fine granular; dark spot at circumference
Elongation of inch sections		″.20, ″.28+, ″.13

No. 5246.

Marks, No. 27.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001267	.000300	0.	.....	
12,500	50,000	.001600	.000333	0.	.....	
15,000	60,000	.001967	.000367	0.	.....	
16,250	65,000	.002133	.000166	.....	.....	
16,500	66,000	.002167	.000034	.....	.....	
16,750	67,000	.002233	.000066	.....	.....	Elastic limit.
17,000	68,000	.014000	.011767	.....	.....	
17,250	69,000	.014500	.000500	.....	.....	
17,500	70,000	.014833	.000333	.....	.....	
17,750	71,000	.015267	.000434	.....	.....	
18,000	72,000	.015833	.000566	.....	.....	
18,250	73,000	.016333	.000500	.....	.....	
18,500	74,000	.017333	.001000	.....	.....	
19,000	76,000	.019333	.002000	.....	.....	
19,500	78,000	.021167	.001834	.....	.....	
20,000	80,000	.023667	.002500	.....	.....	
21,000	84,000	.0300	.006333	.....	.....	
22,000	88,000	.0333	.0033	.....	.....	
23,000	92,000	.0400	.0067	.....	.....	
24,000	96,000	.0500	.0100	.....	.....	
25,000	100,000	.0600	.0100	.....	.....	
26,000	104,000	.0867	.0267	.....	.....	
26,660	106,640	.1333	.0466	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	106,640
Elastic limit per square inch of original section	do...	67,000
Elongation per inch after rupture	inch..	.1967
Elongation per inch under strain at elastic limit	do...	.002233
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1".09 from neck
Character of broken surface		fine silky
Elongation of inch sections		".24*, ".22, ".13

No. 5264.

Marks, No. 28.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000633	.000300	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
12,500	50,000	.001667	.000334	0.	.....	
13,750	55,000	.001833	.000166	.....	.....	
14,000	56,000	.001900	.000067	.....	.....	
14,250	57,000	.001933	.000033	.....	.....	
14,500	58,000	.001967	.000034	.....	.....	
14,750	59,000	.002000	.000033	.....	.....	
15,000	60,000	.002033	.000033	.....	.....	
15,250	61,000	.002067	.000034	.....	.....	Elastic limit.
15,500	62,000	.003333	.001266	.....	.....	
		.012800	.009467	.....	.....	
15,750	63,000	.013333	.000533	.....	.....	
16,000	64,000	.014067	.000734	.....	.....	
16,500	66,000	.015833	.001766	.....	.....	
17,000	68,000	.017667	.001834	.....	.....	
17,500	70,000	.020000	.002333	.....	.....	
18,000	72,000	.021833	.001833	.....	.....	
18,500	74,000	.023667	.001834	.....	.....	
19,000	76,000	.026333	.002666	.....	.....	
19,500	78,000	.028667	.002334	.....	.....	
20,000	80,000	.031167	.002500	.....	.....	
21,000	84,000	.0367	.005533	.....	.....	
22,000	88,000	.0433	.0066	.....	.....	
23,000	92,000	.0567	.0134	.....	.....	
24,000	96,000	.0700	.0133	.....	.....	
25,000	100,000	.1000	.0300	.....	.....	
25,310	101,240	.1367	.0367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	101,240
Elastic limit per square inch of original section	do....	61,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do....	.002067
Reduction in diameter at point of rupture	do....	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1".10 from neck
Character of broken surface.... silky, interspersed with fine granular metal, radiating from the center of the fractured surface.		
Elongation of inch sections		".29*, ".28, ".12

For chemical analysis, see page 702.

No. 5272.

Marks, No. 29.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load
1,250	5,000	.000067	.000067	0.		
2,500	10,000	.000300	.000233			
5,000	20,000	.000633	.000333			
7,500	30,000	.001000	.000367	0.		
10,000	40,000	.001333	.000333			
12,500	50,000	.001667	.000334	0.		
15,000	60,000	.002000	.000333			
16,250	65,000	.002200	.000200			
16,500	66,000	.002267	.000067			
16,750	67,000	.002300	.000033			Elastic limit.
						Load fell.
15,250	61,000	.003800	.001300			
15,500	62,000	.003967	.000367			
15,750	63,000	.007000	.003033			
16,000	64,000	.008700	.001700			
16,250	65,000	.009333	.000633			
16,500	66,000	.009767	.000434			
16,750	67,000	.010400	.000633			
17,000	68,000	.011333	.000933			
17,250	69,000	.011667	.000334			
17,500	70,000	.012767	.001100			
18,000	72,000	.014067	.001300			
18,500	74,000	.015433	.001366			
19,000	76,000	.017500	.002067			
19,500	78,000	.018733	.001233			
20,000	80,000	.020500	.001767			
20,500	82,000	.022400	.001900			
21,000	84,000	.024067	.001667			
21,500	86,000	.026333	.002266			
22,000	88,000	.028067	.001734			
22,500	90,000	.030633	.002566			
23,000	92,000	.032667	.002034			
23,500	94,000	.035633	.002966			
24,000	96,000	.038500	.002867			
24,500	98,000	.042333	.003833			
25,000	100,000	.045833	.003500			
25,500	102,000	.0500	.004167			
26,000	104,000	.0567	.0067			
26,500	106,000	.0633	.0066			
27,000	108,000	.0700	.0067			
27,500	110,000	.0833	.0133			
28,000	112,000	.1033	.0200			
28,160	112,640	.1267	.0234			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	112,640
Elastic limit per square inch of original section	do..	67,000
Elongation per inch after rupture	inch..	.1833
Elongation per inch under strain at elastic limit	do..	.002300
Reduction in diameter at point of rupture	do..	.094
Reduction in area after rupture, per cent of original section		30.6
Position of rupture		at middle of stem
Character of broken surface		fine granular, radiating from a silky center
Elongation of inch sections		".14, "27*, ".14

No. 5285.

Marks, M. G.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001300	.000333	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001433	.000066	.....	.....	Elastic limit.
11,000	44,000	.008833	.007400	.....	.....	
11,250	45,000	.009267	.000434	.....	.....	
11,500	46,000	.010000	.000733	.....	.....	
11,750	47,000	.011000	.001000	.....	.....	
12,000	48,000	.011333	.000333	.....	.....	
12,250	49,000	.011833	.000500	.....	.....	
12,500	50,000	.013000	.001167	.....	.....	
13,000	52,000	.014667	.001667	.....	.....	
13,500	54,000	.016000	.001333	.....	.....	
14,000	56,000	.018167	.002167	.....	.....	
14,500	58,000	.020000	.001833	.....	.....	
15,000	60,000	.022000	.002000	.....	.....	
15,500	62,000	.024333	.002333	.....	.....	
16,000	64,000	.026667	.002334	.....	.....	
16,500	66,000	.029333	.002666	.....	.....	
17,000	68,000	.032333	.003000	.....	.....	
17,500	70,000	.035000	.002667	.....	.....	
18,000	72,000	.038667	.003667	.....	.....	
18,500	74,000	.0467	.008033	.....	.....	
19,000	76,000	.0500	.0033	.....	.....	
19,500	78,000	.0533	.0033	.....	.....	
20,000	80,000	.0600	.0067	.....	.....	
20,500	82,000	.0700	.0100	.....	.....	
21,000	84,000	.0833	.0133	.....	.....	
21,500	86,000	.1100	.0267	.....	.....	
21,620	86,480	.1300	.0200	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,480
Elastic limit per square inch of original section	do...	43,000
Elongation per inch after rupture	inch..	.1700
Elongation per inch under strain at elastic limit	do...	.001433
Reduction in diameter at point of rupture	do...	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		".45 from neck
Character of broken surface		granular at circumference, 50 per cent; silky center, 50 per cent
Elongation of inch sections		".09, ".13, ".29"

For chemical analysis, see page 702.

No. 5299.

Marks, A. 1–30.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000160	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001300	.000333	0.	.....	
12,500	50,000	.001667	.000367	0.	.....	Elastic limit.
12,500	50,000	.007333	.005666	.....	.....	
12,750	51,000	.007833	.000500	.....	.....	
13,000	52,000	.008333	.000500	.....	.....	
13,250	53,000	.008767	.000434	.....	.....	
13,500	54,000	.009867	.001100	.....	.....	
13,750	55,000	.010333	.000466	.....	.....	
14,000	56,000	.011000	.000667	.....	.....	
14,250	57,000	.012000	.001000	.....	.....	
14,500	58,000	.012700	.000700	.....	.....	
15,000	60,000	.014600	.001900	.....	.....	
15,500	62,000	.016200	.001600	.....	.....	
16,000	64,000	.017933	.001733	.....	.....	
16,500	66,000	.019967	.002034	.....	.....	
17,000	68,000	.021967	.002000	.....	.....	
17,500	70,000	.024333	.002366	.....	.....	
18,000	72,000	.026600	.002267	.....	.....	
18,500	74,000	.029667	.003067	.....	.....	
19,000	76,000	.032000	.002333	.....	.....	
19,500	78,000	.034667	.002667	.....	.....	
20,000	80,000	.038667	.004000	.....	.....	
21,000	84,000	.0467	.008033	.....	.....	
22,000	88,000	.0600	.0133	.....	.....	
23,000	92,000	.0833	.0233	.....	.....	
23,560	94,240	.1367	.0534	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	94,240
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1".15 from neck
Character of broken surface		fine, silky
Elongation of inch sections		".28*, ".19, ".13

No. 5320.

Marks, No. 34.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000600	.000300	.....	.....	
7,500	30,000	.000967	.000367	.....	.....	
10,000	40,000	.001267	.000300	0.	.....	
12,500	50,000	.001667	.000400	0.	.....	
13,000	52,000	.001733	.000066	.....	.....	
13,250	53,000	.001767	.000034	.....	.....	Elastic limit.
13,500	54,000	.001867	.000100	.....	.....	
13,750	55,000	.002167	.000300	.....	.....	
14,000	56,000	.002767	.000600	.....	.....	
14,250	57,000	.003500	.000733	.....	.....	
14,500	58,000	.003933	.000433	.....	.....	
14,750	59,000	.004267	.000334	.....	.....	
15,000	60,000	.004767	.000500	.....	.....	
15,500	62,000	.006000	.001233	.....	.....	
16,000	64,000	.006833	.000833	.....	.....	
16,500	66,000	.007667	.000834	.....	.....	
17,000	68,000	.008767	.001100	.....	.....	
17,500	70,000	.009833	.001066	.....	.....	
18,000	72,000	.010867	.001034	.....	.....	
18,500	74,000	.012000	.001133	.....	.....	
19,000	76,000	.013200	.001200	.....	.....	
19,500	78,000	.014333	.001133	.....	.....	
20,000	80,000	.016000	.001667	.....	.....	
21,000	84,000	.018333	.002333	.....	.....	
22,000	88,000	.021000	.002667	.....	.....	
23,000	92,000	.024333	.003333	.....	.....	
24,000	96,000	.027667	.003334	.....	.....	
25,000	100,000	.031667	.004000	.....	.....	
26,000	104,000	.036333	.004666	.....	.....	
27,000	108,000	.0433	.006967	.....	.....	
28,000	112,000	.0533	.0100	.....	.....	
29,000	116,000	.0700	.0167	.....	.....	
29,460	117,840	.0933	.0233	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	117,840
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.1000
Elongation per inch under strain at elastic limit	do....	.001767
Reduction in diameter at point of rupture	do....	.054
Reduction in area after rupture, per cent of original section		18.3
Position of rupture		″.6 from neck
Character of broken surface		granular, with silky spot near the center
Elongation of inch sections		″.08, ″.08, ″.14

CRUCIBLE STEEL.

No. 5300.

Marks, S. J. 31.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001300	.000333	0.	.....	
12,500	50,000	.001633	.000333	0.	.....	
13,750	55,000	.001800	.000167	.....	.....	
14,000	56,000	.001833	.000033	.....	.....	Elastic limit.
14,250	57,000	.010000	.008167	.....	.....	
14,500	58,000	.011233	.001233	.....	.....	
14,750	59,000	.011700	.000467	.....	.....	
15,000	60,000	.012733	.001033	.010067	.010067	
15,500	62,000	.013933	.001200	.....	.....	
16,000	64,000	.015833	.001900	.....	.....	
16,500	66,000	.017667	.001834	.....	.....	
17,000	68,000	.019333	.001666	.....	.....	
17,500	70,000	.021667	.002334	.....	.....	
18,000	72,000	.023667	.002000	.....	.....	
18,500	74,000	.025933	.002266	.....	.....	
19,000	76,000	.028333	.002400	.....	.....	
19,500	78,000	.031000	.002667	.....	.....	
20,000	80,000	.034000	.003000	.....	.....	
20,500	82,000	.0400	.0060	.....	.....	
21,000	84,000	.0433	.0033	.....	.....	
21,500	86,000	.0467	.0034	.....	.....	
22,000	88,000	.0500	.0033	.....	.....	
22,500	90,000	.0567	.0067	.....	.....	
23,000	92,000	.0667	.0100	.....	.....	
23,500	94,000	.0767	.0100	.....	.....	
24,000	96,000	.0933	.0166	.....	.....	
24,490	97,960	.1433	.0500	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	97,960
Elastic limit per square inch of original section	do...	56,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.001833
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1" .1 from neck
Character of broken surface		fine silky
Elongation of inch sections		".32*, ".24, ".14

CRUCIBLE STEEL.

No. 5314.

Marks, 33.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	0.	.....	
10,000	40,000	.001300	.000333	0.	.....	
12,500	50,000	.001633	.000333	.....	.....	
15,000	60,000	.002000	.000367	.....	.....	
15,750	63,000	.002067	.000067	.....	.....	Elastic limit.
						Load fell.
14,250	57,000	.004033	.001966	.....	.....	
14,500	58,000	.004833	.000800	.....	.....	
14,750	59,000	.013333	.008500	.....	.....	
15,000	60,000	.013767	.000434	.....	.....	
15,250	61,000	.014333	.000566	.....	.....	
15,500	62,000	.015267	.000934	.....	.....	
15,750	63,000	.015833	.000566	.....	.....	
16,000	64,000	.017067	.001234	.....	.....	
16,500	66,000	.019000	.001933	.....	.....	
17,000	68,000	.020667	.001667	.....	.....	
17,500	70,000	.023333	.002666	.....	.....	
18,000	72,000	.025667	.002334	.....	.....	
18,500	74,000	.028333	.002666	.....	.....	
19,000	76,000	.031000	.002667	.....	.....	
19,500	78,000	.034333	.003333	.....	.....	
20,000	80,000	.038000	.003667	.....	.....	
20,500	82,000	.041667	.003667	.....	.....	
21,000	84,000	.046667	.005000	.....	.....	
21,500	86,000	.051667	.005000	.....	.....	
22,000	88,000	.058333	.006666	.....	.....	
22,500	90,000	.066667	.008334	.....	.....	
23,000	92,000	.076667	.010000	.....	.....	
23,500	94,000	.1000	.023333	.....	.....	
23,840	95,360	.1433	.0433	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,360
Elastic limit per square inch of original section	do...	63,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.002067
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1″.3 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.15, ″.28, ″.22

CRUCIBLE STEEL.

No. 5337.

Marks, No. 136.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
10,000	40,000	.001367	.000334	0.	.....	
12,500	50,000	.001667	.000300	.....	.....	
15,000	60,000	.002100	.000433	.....	.....	Elastic limit.
15,250	61,000	.002167	.000067	.....	.....	
15,500	62,000	.002267	.000100	.....	.....	
15,750	63,000	.002333	.000066	.....	.....	
16,000	64,000	.004833	.002500	.....	.....	
16,250	65,000	.005367	.000534	.....	.....	
16,500	66,000	.006033	.000666	.....	.....	
16,750	67,000	.006367	.000334	.....	.....	
17,000	68,000	.006933	.000566	.....	.....	
17,500	70,000	.008300	.001367	.....	.....	
18,000	72,000	.009333	.001033	.....	.....	
18,500	74,000	.010500	.001167	.....	.....	
19,000	76,000	.011667	.001167	.....	.....	
19,500	78,000	.012967	.001300	.....	.....	
20,000	80,000	.014100	.001133	.....	.....	
21,000	84,000	.017067	.002967	.....	.....	
22,000	88,000	.019767	.002700	.....	.....	
23,000	92,000	.023000	.003233	.....	.....	
24,000	96,000	.026600	.003600	.....	.....	
25,000	100,000	.030667	.004067	.....	.....	
26,000	104,000	.0367	.006033	.....	.....	
27,000	108,000	.0433	.0066	.....	.....	
28,000	112,000	.0500	.0067	.....	.....	
29,000	116,000	.0667	.0167	.....	.....	
29,980	119,920	.1100	.0433	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	119,920
Elastic limit per square inch of original section	do...	60,000
Elongation per inch after rupture	inch..	.1333
Elongation per inch under strain at elastic limit	do...	.002100
Reduction in diameter at point of rupture	do...	.064
Reduction in area after rupture, per cent of original section		21.4
Position of rupture		1".3 from neck
Character of broken surface		granular, 60 per cent; silky eccentric spot, 40 per cent
Elongation of inch sections		".10, ".17, ".13

CRUCIBLE STEEL.

No. 5338.

Marks, No. 237.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, ″3.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001333	.000366	0.	.....	
12,500	50,000	.001700	.000367	.....	.....	
15,000	60,000	.002033	.000333	0.	.....	
16,000	64,000	.002167	.000134	.....	.....	Elastic limit.
16,250	65,000	.006767	.004600	.....	.....	
16,500	66,000	.007333	.000566	.....	.....	
16,750	67,000	.007700	.000367	.....	.....	
17,000	68,000	.008333	.000633	.....	.....	
17,250	69,000	.008733	.000400	.....	.....	
17,500	70,000	.009600	.000867	.....	.....	
18,000	72,000	.010700	.001100	.....	.....	
18,500	74,000	.011667	.000967	.....	.....	
19,000	76,000	.013000	.001333	.....	.....	
19,500	78,000	.014333	.001333	.....	.....	
20,000	80,000	.015500	.001167	.....	.....	
21,000	84,000	.018500	.003000	.....	.....	
22,000	88,000	.021400	.002900	.....	.....	
23,000	92,000	.024500	.003100	.....	.....	
24,000	96,000	.028667	.004167	.....	.....	
25,000	100,000	.032667	.004000	.....	.....	
26,000	104,000	.038267	.005600	.....	.....	
27,000	108,000	.044900	.006633	.....	.....	
28,000	112,000	.0567	.0118	.....	.....	
29,000	116,000	.0767	.0200	.....	.....	
29,600	118,400	.1100	.0333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	118,400
Elastic limit per square inch of original section	do...	64,000
Elongation per inch after rupture	inch..	.1200
Elongation per inch under strain at elastic limit	do...	.002167
Reduction in diameter at point of rupture	do...	.054
Reduction in area after rupture, per cent of original section		18.3
Position of rupture		″.55 from neck
Character of broken surface	granular, 60 per cent; silky eccentric spot, 40 per cent	
Elongation of inch sections		″.09, ″.11, ″.19

BESSEMER STEEL.

No. 5302.

Marks, 32.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000233	.000133	.....	.....	
5,000	20,000	.000533	.000300	.....	.....	
7,500	30,000	.000867	.000334	.....	.....	
10,000	40,000	.001200	.000333	0.	.....	
12,500	50,000	.001533	.000333	0.	.....	
15,000	60,000	.001967	.000434	—.000033	—.000033	
17,500	70,000	.002300	.000333	0.	.000033	Elastic limit.
17,750	71,000	.002333	.000033	.....	.....	
18,000	72,000	.002367	.000034	.....	.....	
18,250	73,000	.004333	.001966	.....	.....	
18,500	74,000	.006333	.002000	.....	.....	
18,750	75,000	.006800	.000467	.....	.....	
19,000	76,000	.007833	.000533	.....	.....	
19,500	78,000	.009533	.001700	.....	.....	
20,000	80,000	.009667	.001134	.....	.....	
20,500	82,000	.010667	.001000	.....	.....	
21,000	84,000	.012000	.001333	.....	.....	
21,500	86,000	.013133	.001133	.....	.....	
22,000	88,000	.014333	.001200	.....	.....	
22,500	90,000	.015667	.001334	.....	.....	
23,000	92,000	.017000	.001333	.....	.....	
23,500	94,000	.018267	.001267	.....	.....	
24,000	96,000	.020000	.001733	.....	.....	
24,500	98,000	.021000	.001000	.....	.....	
25,000	100,000	.022833	.001833	.....	.....	
26,000	104,000	.0267	.003867	.....	.....	
27,000	108,000	.0300	.0033	.....	.....	
28,000	112,000	.0367	.0067	.....	.....	
29,000	116,000	.0400	.0033	.....	.....	
30,000	120,000	.0467	.0067	.....	.....	
31,000	124,000	.0567	.0100	.....	.....	
32,000	128,000	.0767	.0200	.....	.....	
32,190	128,760	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	128,760
Elastic limit per square inch of original section	do...	70,000
Elongation per inch after rupture	inch..	.0733
Elongation per inch under strain at elastic limit	do...	.002300
Reduction in diameter at point of rupture	do...	.024
Reduction in area after rupture, per cent of original section		8.4
Position of rupture		″.85 from neck
Character of broken surface		fine granular
Elongation of inch sections		″.07, ″.07, ″.08*

SAMPLES TAKEN FROM A ROLLED RIFLE BARREL.

No. 5327.

Marks, 32.
Breech end.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000333	.000233			
5,000	20,000	.000667	.000334			
7,500	30,000	.001000	.000333			
10,000	40,000	.001333	.000333	0.		
12,500	50,000	.001700	.000367	.000033	.000033	
15,000	60,000	.002067	.000367	.000033	0.	Elastic limit.
15,250	61,000	.002200	.000133			
15,500	62,000	.005000	.002800			
15,750	63,000	.005667	.000667			
16,000	64,000	.006333	.000666			
16,250	65,000	.006900	.000567			
16,500	66,000	.007233	.000333			
16,750	67,000	.007667	.000434			
17,000	68,000	.008600	.000933			
17,250	69,000	.009033	.000433			
17,500	70,000	.009667	.000634	.006733	.006700	
18,000	72,000	.010900	.001233			
18,500	74,000	.012100	.001200			
19,000	76,000	.013333	.001233			
19,500	78,000	.014933	.001600			
20,060	80,000	.016133	.001200			
20,500	82,000	.017567	.001434			
21,000	84,000	.018733	.001166			
22,000	88,000	.021967	.003234			
23,000	92,000	.025333	.003366			
24,000	96,000	.029000	.003667			
25,000	100,000	.033000	.004000			
26,000	104,000	.038000	.005000			
27,000	108,000	.044667	.006667			
28,000	112,000	.0533	.008633			
29,000	116,000	.0700	.0167			
29,740	118,960	.1133	.0433			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	118,960
Elastic limit per square inch of original section	do...	60,000
Elongation per inch after rupture	inch..	.1433
Elongation per inch under strain at elastic limit	do...	.002067
Reduction in diameter at point of rupture	do...	.074
Reduction in area after rupture, per cent of original section		24.6
Position of rupture		1″.37 from neck
Character of broken surface		fine granular, radiating from a dull eccentric spot
Elongation of inch sections		″.10, ″.20, ″.13

No. 5328.

Marks, 32.
Muzzle end.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000333	.000233	.....	.....	
4,000	20,000	.000633	.000300	.....	.....	
6,000	30,000	.001000	.000367	.....	.....	
8,000	40,000	.001333	.000333	0.	.....	
10,000	50,000	.001700	.000367	0.	.....	
12,000	60,000	.002033	.000333	0.	.....	
12,200	61,000	.002067	.000034	.....	.....	
12,400	62,000	.002100	.000033	.....	.....	
12,600	63,000	.002133	.000033	.....	.....	Elastic limit.
12,800	64,000	.002233	.000100	.....	.....	
13,000	65,000	.002300	.000067	.....	.....	
		.005300	.003000	.....	.....	
13,200	66,000	.005333	.000033	.....	.....	
13,400	67,000	.005667	.000334	.....	.....	
13,600	68,000	.007333	.000666	.....	.....	
13,800	69,000	.008300	.000967	.....	.....	
14,000	70,000	.008933	.000633	.005967	.005967	
14,400	72,000	.009933	.001000	.....	.....	
14,800	74,000	.010733	.000800	.....	.....	
15,200	76,000	.012000	.001267	.....	.....	
15,600	78,000	.013733	.001733	.....	.....	
16,000	80,000	.015033	.001300	.....	.....	
16,400	82,000	.016233	.001200	.....	.....	
16,800	84,000	.017333	.001100	.....	.....	
17,200	86,000	.021267	.003934	.....	.....	
18,400	92,000	.023700	.002433	.....	.....	
19,200	96,000	.027700	.004000	.....	.....	
20,000	100,000	.031467	.003767	.....	.....	
20,800	104,000	.035800	.004333	.....	.....	
21,600	108,000	.0433	.0075	.....	.....	
22,400	112,000	.0533	.0100	.....	.....	
23,200	116,000	.0633	.0100	.....	.....	
24,000	120,000	.0833	.0200	.....	.....	
24,160	120,800	.1100	.0267	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	120,800
Elastic limit per square inch of original section	do	63,000
Elongation per inch after rupture	inch	.1500
Elongation per inch under strain at elastic limit	do	.002133
Reduction in diameter at point of rupture	do	.075
Reduction in area after rupture, per cent of original section		27.4
Position of rupture		1".35 from neck
Character of broken surface		fine granular and silky metal interspersed
Elongation of inch sections		".11, ".21*, ".13

ADDITIONAL SPECIMENS FROM ROLLED BARREL TAKEN OUT AFTER REANNEALING AT WATERTOWN ARSENAL.

No. 5344.

Taken out after reannealing by heating to a low cherry color and cooling in lime.

Marks, 32.
Breech middle specimen.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000067	.000067	0.	.....	
2,000	10,000	.000300	.000233	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001700	.000367	0.	.....	
12,000	60,000	.002100	.000400	0.	.....	
12,200	61,000	.002133	.000033	.....	.....	
12,400	62,000	.002200	.000067	.....	.....	
12,600	63,000	.002233	.000033	.....	.....	
12,800	64,000	.002300	.000067	.....	.....	
13,000	65,000	.002333	.000033	.....	.....	
13,200	66,000	.002367	.000034	.....	.....	
13.400	67,000	.002400	.000033	.....	.....	
13,600	68,000	.002433	.000033	.....	.....	
13,800	69,000	.002433	0.	.....	.....	
14,000	70,000	.002467	.000034	0.	.....	
14,200	71,000	.002533	.000066	.....	.....	
14,400	72,000	.002567	.000034	.....	.....	
14,600	73,000	.002633	.000066	.....	.....	Elastic limit. Load fell.
13,600	68,000	.003533	.000900	.....	.....	
13,800	69,000	.004600	.001067	.....	.....	
14,000	70,000	.011667	.007067	.....	.....	
14,200	71,000	.012000	.000333	.....	.....	
14,400	72,000	.012367	.000367	.....	.....	
14,600	73,000	.013067	.000700	.....	.....	
14,800	74,000	.013567	.000500	.....	.....	
15,200	76,000	.015167	.001600	.....	.....	
15,600	78,000	.016333	.001166	.....	.....	
16,000	80,000	.017733	.001400	.....	.....	
16,800	84,000	.021300	.003567	.....	.....	
17,600	88,000	.024500	.003200	.....	.....	
18,400	92,000	.027667	.003167	.....	.....	
19,200	96,000	.031967	.004300	.....	.....	
20,000	100,000	.036500	.004533	.031700	.031700	
20,800	104,000	.0433	.0068	.....	.....	
21,600	108,000	.0533	.0100	.....	.....	
22,400	112,000	.0633	.0100	.....	.....	
23,200	116,000	.0833	.0200	.....	.....	
23,620	118,100	.1267	.0434	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	118,100
Elastic limit per square inch of original section	do...	73,000
Elongation per inch after rupture	inch..	.1933
Elongation per inch under strain at elastic limit	do...	.002633
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		1″.5 from neck
Character of broken surface		fine, silky, interspersed with fine granulation; cup-shaped ends
Elongation of inch sections		″.12, ″.31*, ″.15

No. 5345.

Specimen taken out at the same time as No. 5344.

Marks, 32.
Muzzle middle specimen.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000067	.000067	0.	.....	
2,000	10,000	.000200	.000233	.....	.....	
4,000	20,000	.000600	.000800	.....	.....	
6,000	30,000	.000967	.000367	.....	.....	
8,000	40,000	.001333	.000366	.....	.....	
10,000	50,000	.001667	.000334	0.	.....	
12,000	60,000	.002000	.000333	0.	.....	
14,000	70,000	.002367	.000367	0.	.....	
14,200	71,000	.002367	0.	.....	.....	
14,400	72,000	.002400	.000033	.....	.....	
14,600	73,000	.002433	.000033	.....	.....	
14,800	74,000	.002467	.000034	.....	.....	
15,000	75,000	.002500	.000033	.....	.....	Elastic limit.
						Load fell.
14,600	70,000	.002800	.000300	.....	.....	
14,200	71,000	.004000	.000700	.....	.....	
14,400	72,000	.010000	.006000	.....	.....	
14,600	73,000	.010033	.000033	.....	.....	
14,800	74,000	.011233	.000400	.....	.....	
15,000	75,000	.011800	.000467	.....	.....	
15,200	76,000	.012333	.000533	.....	.....	
15,600	78,000	.013833	.001500	.....	.....	
16,000	80,000	.015067	.001234	.....	.....	
16,400	82,000	.018067	.003000	.....	.....	
16,800	84,000	.021333	.002966	.....	.....	
17,600	88,000	.024667	.003334	.....	.....	
18,400	92,000	.027833	.003166	.....	.....	
19,200	96,000	.032733	.004900	.027667	.027667	
20,000	100,000	.0367	.0040	.....	.....	
20,800	104,000	.0467	.0100	.....	.....	
21,600	108,000	.0533	.0066	.....	.....	
22,400	112,000	.0667	.0134	.....	.....	
23,200	116,000	.0967	.0300	.....	.....	
24,000	120,000	.1133	.0266	.....	.....	Tensile strength.
24,250	121,250					

General summary.

Tensile strength per square inch of original section	pounds..	121,250
Elastic limit per square inch of original section	do....	75,000
Elongation per inch after rupture	inch..	.1700
Elongation per inch under strain at elastic limit	do....	.002500
Reduction in diameter at point of rupture	do....	.125
Reduction in area after rupture, per cent of original section		43.8
Position of rupture		".60 from neck
Character of broken surface		silky, interspersed with fine granulation; cup-shaped ends
Elongation of inch sections		".11, ".11, ".39*

No. 5348.

Specimen after reannealing by heating to a high red heat, approaching yellow color, and cooling in lime.

Marks, 32.
Middle specimen.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000333	.000233	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	0.	.....	
10,000	50,000	.001700	.000367	.....	.....	
12,000	60,000	.002033	.000333	.000033	.000033	
14,000	70,000	.002433	.000400	.000033	0.	
14,200	71,000	.002467	.000034	.....	.....	
14,400	72,000	.002500	.000033	.....	.....	Elastic limit.
						Load fell.
13,600	68,000	.005000	.002500	.....	.....	
13,800	69,000	.006167	.001167	.....	.....	
14,000	70,000	.010233	.004066	.....	.....	
14,200	71,000	.010667	.000434	.....	.....	
14,400	72,000	.011133	.000466	.....	.....	
14,600	73,000	.011667	.000534	.....	.....	
14,800	74,000	.012333	.000666	.....	.....	
15,200	76,000	.013667	.001334	.....	.....	
15,600	78,000	.015000	.001333	.....	.....	
16,000	80,000	.016500	.001500	.....	.....	
16,800	84,000	.018867	.002367	.....	.....	
17,600	88,000	.022167	.003300	.....	.....	
18,400	92,000	.026433	.004266	.....	.....	
19,200	96,000	.029633	.003200	.....	.....	
20,000	100,000	.034033	.004400	.....	.....	
20,800	104,000	.0400	.005967	.....	.....	
21,600	108,000	.0467	.0067	.....	.....	
22,400	112,000	.0567	.0100	.....	.....	
23,200	116,000	.0700	.0133	.....	.....	
23,860	119,300	.1133	.0433	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	119,300
Elastic limit per square inch of original section	do...	72,000
Elongation per inch after rupture	inch..	.1600
Elongation per inch under strain at elastic limit	do...	.002500
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		″.8 from neck
Character of broken surface		silky, interspersed with fine granulation; cup-shaped ends
Elongation of inch sections		″.27*, ″.12, ″.09

BESSEMER STEEL.

No. 5321.

Marks, No. 35.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000200	.000233	.....	.....	
5,000	20,000	.000667	.000267	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
12,500	50,000	.001667	.000334	0.	.....	
15,000	60,000	.002033	.000366	0.	.....	
15,250	61,000	.002067	.000034	.....	.....	
15,500	62,000	.002133	.000066	.....	.....	Elastic limit.
15,750	63,000	.002233	.000100	.....	.....	
16,000	64,000	.002333	.000100	.....	.....	
16,250	65,000	.002633	.000300	.....	.....	
16,500	66,000	.003133	.000500	.....	.....	
16,750	67,000	.003400	.000267	.....	.....	
17,000	68,000	.010000	.000600	.....	.....	
17,250	69,000	.010433	.000433	.....	.....	
17,500	70,000	.011300	.000867	.....	.....	
18,000	72,000	.012667	.001367	.....	.....	
18,500	74,000	.014000	.001333	.....	.....	
19,000	76,000	.015667	.001667	.....	.....	
19,500	78,000	.017000	.001333	.....	.....	
20,000	80,000	.018667	.001667	.....	.....	
20,500	82,000	.020000	.001333	.....	.....	
21,000	84,000	.021667	.001667	.....	.....	
21,500	86,000	.023333	.001666	.....	.....	
22,000	88,000	.025333	.002000	.....	.....	
22,500	90,000	.027333	.002000	.....	.....	
23,000	92,000	.029000	.001667	.....	.....	
23,500	94,000	.031333	.002333	.....	.....	
24,000	96,000	.033667	.002334	.....	.....	
24,500	98,000	.036333	.002666	.....	.....	
25,000	100,000	.039000	.002667	.....	.....	
26,000	104,000	.0467	.0077	.....	.....	
27,000	108,000	.0567	.0100	.....	.....	
28,000	112,000	.0733	.0166	.....	.....	
28,940	115,760	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	115,760
Elastic limit per square inch of original section	do...	62,000
Elongation per inch after rupture	inch..	.1000
Elongation per inch under strain at elastic limit	do...	.002133
Reduction in diameter at point of rupture	do...	.034
Reduction in area after rupture, per cent of original section		11.6
Position of rupture		".45 from neck
Character of broken surface		fine granular
Elongation of inch sections		".09,".11,".10*

BESSEMER STEEL.

No. 5339.

Marks, No. 38.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
12,500	50,000	.001700	.000367	0.	.....	
15,000	60,000	.002033	.000333	0.	.....	
17,000	68,000	.002267	.000734	.....	.....	
17,250	69,000	.002333	.000066	.....	.....	Elastic limit. Load fell.
15,750	63,000	.003433	.001100	.....	.....	
16,000	64,000	.007167	.003734	.....	.....	
16,250	65,000	.008700	.001533	.....	.....	
16,500	66,000	.008933	.000233	.....	.....	
16,750	67,000	.009067	.000134	.....	.....	
17,000	68,000	.009500	.000433	.....	.....	
17,250	69,000	.010000	.000500	.....	.....	
17,500	70,000	.011333	.001333	.....	.....	
17,750	71,000	.011933	.000600	.....	.....	
18,000	72,000	.012667	.000734	.....	.....	
18,500	74,000	.013667	.001000	.....	.....	
19,000	76,000	.015000	.001333	.....	.....	
19,500	78,000	.016667	.001667	.....	.....	
20,000	80,000	.018333	.001666	.....	.....	
20,500	82,000	.019667	.001334	.....	.....	
21,000	84,000	.02 500	.001833	.....	.....	
21,500	86,000	.023100	.001600	.....	.....	
22,000	88,000	.024833	.001733	.....	.....	
22,500	90,000	.026667	.001834	.....	.....	
23,000	92,000	.028667	.002000	.....	.....	
23,500	94,000	.030733	.002066	.....	.....	
24,000	96,000	.033333	.002600	.....	.....	
24,500	98,000	.035833	.002500	.....	.....	
25,000	100,000	.039067	.003234	.....	.....	
26,000	104,000	.0467	.007633	.....	.....	
27,000	108,000	.0567	.0100	.....	.....	
28,000	112,000	.0733	.0166	.....	.....	
28,920	115,680	.1300	.0567	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	115,680
Elastic limit per square inch of original section	do...	69,000
Elongation per inch after rupture	inch..	.1300
Elongation per inch under strain at elastic limit	do...	.002333
Reduction in diameter at point of rupture	do...	.054
Reduction in area after rupture, per cent of original section		18.3
Position of rupture		1″.55 from neck
Character of broken surface		fine granular, radiating from a dull spot near the circumference
Elongation of inch sections		″.13, ″.18, ″.14

No. 5349.

Marks, No. 39.
Diameter, ".564."
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads. Total.	Applied loads. Per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000267	.000167			
3,000	20,000	.000600	.000333			
3,500	30,000	.000967	.000367			
4,000	40,000	.001333	.000366	0.		
4,500	50,000	.001667	.000334			
5,000	60,000	.002000	.000333	0.		
5,250	64,000	.002133	.000133			Elastic limit.
4,500	58,000	.003833	.001700			Load fell.
4,750	59,000	.004167	.000334			
15,000	60,000	.006333	.002166			
		.010667	.004334			
15,250	61,000	.010967	.000300			
15,500	62,000	.011333	.000366			
16,000	64,000	.012933	.001600			
16,500	66,000	.014667	.001734			
17,000	68,000	.016667	.002000			
17,500	70,000	.018333	.001666			
18,000	72,000	.020600	.002267			
18,500	74,000	.022667	.002067			
19,000	76,000	.025000	.002333			
19,500	78,000	.027667	.002667			
20,000	80,000	.030000	.002333			
20,500	82,000	.032667	.002667			
21,000	84,000	.035667	.003000			
21,500	86,000	.039333	.003666			
22,000	88,000	.0433	.003967			
22,500	90,000	.0500	.0067			
23,000	92,000	.0533	.0033			
23,500	94,000	.0600	.0067			
24,000	96,000	.0667	.0067			
24,500	98,000	.0767	.0100			
25,000	100,000	.0933	.0166			
25,500	102,000	.1233	.0300			
25,500	102,240	.1367	.0134			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	102,240
Elastic limit per square inch of original section	do....	64,000
Elongation per inch after rupture	inch..	.2933
Elongation per inch under strain at elastic limit	do....	.002133
Elongation per inch at point of rupture	do....	.134
Reduction in diameter		41.9
Reduction in area after rupture, per cent of original section		
Position of rupture		at middle of stem
Character of broken surface		silky, interspersed with fine granulation
Elongation of inch section		".16, ".36", ".15

CRUCIBLE STEEL FOR PRESSURE BARRELS.

No. 5350.

Marks, No. 40.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000633	.000366	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001300	.000333	0.	.....	
12,500	50,000	.001667	.000367	.....	.....	Elastic limit.
						Load fell.
12,000	48,000	.003833	.002166	.....	.....	
12,250	49,000	.005300	.001467	.....	.....	
12,500	50,000	.006000	.000700	.....	.....	
12,750	51,000	.006700	.000700	.....	.....	
13,000	52,000	.007400	.000700	.....	.....	
13,500	54,000	.008333	.000933	.....	.....	
14,000	56,000	.010067	.001734	.....	.....	
14,500	58,000	.011667	.001600	.....	.....	
15,000	60,000	.013000	.001323	.....	.....	
15,500	62,000	.014500	.001500	.....	.....	
16,000	64,000	.016200	.001700	.....	.....	
16,500	66,000	.018000	.001800	.....	.....	
17,000	68,000	.020000	.002000	.....	.....	
17,500	70,000	.022000	.002000	.....	.....	
18,000	72,000	.024000	.002000	.....	.....	
18,500	74,000	.026167	.002167	.....	.....	
19,000	76,000	.028833	.002666	.....	.....	
19,500	78,000	.031333	.002500	.....	.....	
20,000	80,000	.034333	.003000	.....	.....	
20,500	82,000	.037333	.003000	.....	.....	
21,000	84,000	.041333	.004000	.....	.....	
21,500	86,000	.045667	.004334	.....	.....	
22,000	88,000	.050000	.004333	.....	.....	
22,500	90,000	.0567	.0067	.....	.....	
23,000	92,000	.0667	.0100	.....	.....	
23,500	94,000	.0833	.0166	.....	.....	
24,000	96,000	.1033	.0200	.....	.....	
24,190	96,760	.1367	.0334	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	96,760
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1".7 from neck
Character of broken surface		silky
Elongation of inch sections		".16, ".38*, ".14

No. 5353.

Marks, 41.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
12,500	50,000	.001667	.000334	.....	.....	
15,000	60,000	.002000	.000333	0.	.....	
16,750	67,000	.002200	.000200	.....	.....	Elastic limit.
17,000	68,000	.002500	.000300	.....	.....	
17,250	69,000	.004833	.002333	.....	.....	
17,500	70,000	.005133	.000300	.002333	.002336	
17,750	71,000	.005533	.000400	.....	.....	
18,000	72,000	.006033	.000500	.....	.....	
18,250	73,000	.006667	.000634	.....	.....	
18,500	74,000	.007333	.000666	.....	.....	
19,000	76,000	.008167	.000834	.....	.....	
19,500	78,000	.009333	.001166	.....	.....	
20,000	80,000	.010667	.001334	.....	.....	
21,000	84,000	.013967	.003300	.....	.....	
22,000	88,000	.016533	.002566	.....	.....	
23,000	92,000	.019333	.002800	.....	.....	
24,000	96,000	.022733	.003400	.....	.....	
25,000	100,000	.026500	.003767	.....	.....	
26,000	104,000	.030667	.004167	.....	.....	
27,000	108,000	.036367	.005700	.....	.....	
28,000	112,000	.044000	.007633	.....	.....	
29,000	116,000	.0600	.0160	.....	.....	
29,880	119,520	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	119,520
Elastic limit per square inch of original section	do...	67,000
Elongation per inch after rupture	inch..	.1900
Elongation per inch under strain at elastic limit	do...	.002200
Reduction in diameter at point of rupture	do...	.204
Reduction in area after rupture, per cent of original section		59.3
Position of rupture		at middle of stem
Character of broken surface		fine, silky; cup-shaped ends
Elongation of inch sections		".10, ".38*, ".09

No. 5356.

Marks, 42.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	.....	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001367	.000367	.....	.....	
12,000	48,000	.001633	.000266	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	Elastic limit.
12,500	50,000	.003300	.001633	.001666	.001633	
12,000	48,000	.012700	.009400	.....	.....	
12,250	49,000	.013400	.000700	.....	.....	
12,500	50,000	.014200	.000800	.....	.....	
12,750	51,000	.014867	.000667	.....	.....	
13,000	52,000	.015667	.000800	.....	.....	
13,250	53,000	.016667	.001000	.....	.....	
13,500	54,000	.017500	.000833	.....	.....	
14,000	56,000	.019500	.002000	.....	.....	
14,500	58,000	.021667	.002167	.....	.....	
15,000	60,000	.023500	.001833	.....	.....	
16,000	64,000	.028000	.004500	.....	.....	
17,000	68,000	.034333	.006333	.....	.....	
18,000	72,000	.040633	.006300	.....	.....	
19,000	76,000	.048333	.007700	.....	.....	
20,000	80,000	.0633	.014967	.....	.....	
21,000	84,000	.0833	.0200	.....	.....	
22,000	88,000	.1167	.0334	.....	.....	
22,190	88,760	.1733	.0566	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,760
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2400
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.84 from neck
Character of broken surface		silky
Elongation of inch sections		″.16, ″.28, ″.18

TABULATION OF TENSION SPECIMENS FROM RIFLE-BARREL STEEL.—(LENGTH OF STEMS, 3″).

No. of test.	Mark on specimen.	Diameter.	Sectional area.	Elastic limit per square inch.	Ultimate strength per square inch.	Elongation in 3 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.	Remarks.
		Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Per ct.*	*Per ct.*		″ ″ ″	
5284	12	.564	.25	64,000	100,080	22.3	44.6	Fine silky	.15, .37*, .15	
5225	26	.564	.25	59,000	104,400	18.7	30.6	Fine granular; dark spot at circumference	.20, .23*, .13	
5246	27	.564	.25	67,000	106,640	19.7	39.2	Fine silky	.24*, .22, .13	
5264	28	.564	.25	61,000	101,240	20.0	39.2	Silky, interspersed with fine granular metal	.29*, .28, .12	
5272	29	.564	.25	67,000	112,640	18.3	30.6	Fine granular radiating from a silky center	.14, .27*, .14	
5285	M. G	.564	.25	43,000	86,480	17.0	36.4	Granular at circumference 50 per cent, silky center 50 per cent.	.09, .13, .29*	Moss & Gamble's manufacture, Sheffield, England.
5299	A. 1–30	.564	.25	50,000	94,240	20.0	39.2	Fine silky	.28*, .19, .13	
5320	34	.564	.25	53,000	117,840	10.0	18.3	Granular with silky spot near the center	.08, .08, .14	
5300	S. J. 31	.564	.25	56,000	97,960	23.3	44.6	Fine silky	.32*, .24, .14	
5314	33	.564	.25	63,000	95,360	21.7	39.2	....do	.15, .28*, .22	
5337	136	.564	.25	60,000	119,920	13.3	21.4	Granular, 60 per cent; silky eccentric spot, 40 per cent.	.10, .17*, .13	
5338	237	.564	.25	64,000	118,400	12.0	18.3	....do	.09, .11, .16*	
5302	32	.564	.25	70,000	128,760	7.3	8.4	Fine granular	.07, .07, .08*	
5327	Breech 32	.564	.25	60,000	118,960	14.3	24.6	Fine granular, radiating from a dull eccentric spot	.10, .20*, .13	From a rolled barrel.
5328	Muzzle 32	.505	.20	63,000	120,800	15.0	27.4	Fine granular and silky metal interspersed	.11, .21*, .13	Do.
5344	Breech middle 32	.505	.20	73,000	118,100	19.3	43.3	Fine silky interspersed with fine granulation	.12, .31*, .15	Specimens from rolled barrel No. 32 after reannealing at Watertown Arsenal.
5345	Muzzle middle 32	.505	.20	75,000	121,250	17.0	43.3	Silky interspersed with fine granulation	.11, .11, .39*	
5348	Middle 32	.505	.20	72,000	119,300	16.0	49.7	....do	.27*, .12, .09	
5321	35	.564	.25	62,000	115,760	10.0	11.6	Fine granular	.09, .11, .10*	
5339	38	.564	.25	69,000	115,680	15.0	18.3	Fine granular, radiating from a dull spot near circumference.	.13, .18*, .14	
5349	39	.564	.25	64,000	102,240	22.3	41.9	Silky, interspersed with fine granulation	.16, .36*, .15	
5350	40	.564	.25	50,000	96,760	22.7	44.6	Silky	.16, .38*, .14	Pressure barrels.
5353	41	.564	.25	67,000	119,520	19.0	59.3	Fine silky	.10, .38*, .09	
5356	42	.564	.25	49,000	88,760	24.0	44.6	Silky	.16, .38*, .18	

ROLLED RIFLE BARRELS, .30 CALIBER.

SPECIALLY TREATED.

No. 39, Reheated in Gas Furnace and Annealed in Charcoal.

No. 5361.

Marks, 39. Breech end.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	
10,000	40,000	.001367	.000334	0.	.....	
12,500	50,000	.001733	.000366	0.	.....	
14,000	56,000	.001933	.000200	.....	.....	
14,250	57,000	.001967	.000034	.....	.....	Elastic limit.
						Load fell.
12,750	51,000	.004033	.002066	.....	.....	
13,000	52,000	.005133	.001100	.....	.....	
13,250	53,000	.007000	.001867	.....	.....	
13,500	54,000	.009333	.002333	.....	.....	
13,750	55,000	.010800	.000767	.....	.....	
14,000	56,000	.011233	.000433	.....	.....	
14,250	57,000	.012000	.000967	.....	.....	
14,500	58,000	.012333	.000333	.....	.....	
14,750	59,000	.013700	.000967	.....	.....	
15,000	60,000	.014667	.000967	.....	.....	
15,500	62,000	.016933	.002266	.....	.....	
16,000	64,000	.018667	.001734	.....	.....	
16,500	66,000	.021000	.002333	.....	.....	
17,000	68,000	.023333	.002333	.....	.....	
17,500	70,000	.025833	.002500	.....	.....	
18,000	72,000	.028333	.002500	.....	.....	
18,500	74,000	.031000	.002667	.....	.....	
19,000	76,000	.034167	.003167	.....	.....	
19,500	78,000	.037500	.003333	.....	.....	
20,000	80,000	.041500	.004000	.....	.....	
20,500	82,000	.045333	.003833	.....	.....	
21,000	84,000	.049833	.004500	.....	.....	
21,500	86,000	.055667	.005834	.....	.....	
22,000	88,000	.0667	.011033	.....	.....	
22,500	90,000	.0733	.0066	.....	.....	
23,000	92,000	.0867	.0134	.....	.....	
23,500	94,000	.1067	.0200	.....	.....	
23,910	95,640	.1563	.0496	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,640
Elastic limit per square inch of original section	do...	57,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.001967
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		".94 from neck
Character of broken surface		silky, and fine granular metal interspersed
Elongation of inch sections		".23", ".18, ".14

No. 5362.

Marks, 39. Muzzle end.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000367	.000234	.....	.....	
4,000	20,000	.000700	.000333	.....	.....	
6,000	30,000	.001033	.000333	.....	.....	
8,000	40,000	.001400	.000367	.....	.....	
10,000	50,000	.001733	.000333	.000033	.000033	
11,000	55,000	.001867	.000134	.....	.....	
11,200	56,000	.001933	.000066	.....	.....	
11,400	57,000	.002000	.000067	.....	.....	Elastic limit.
						Load fell.
10,400	52,000	.003600	.001600	.....	.....	
10,600	53,000	.004533	.000933	.....	.....	
10,800	54,000	.006000	.003467	.....	.....	
11,000	55,000	.009667	.001667	.....	.....	
11,200	56,000	.012100	.002433	.....	.....	
11,400	57,000	.012833	.000733	.....	.....	
11,600	58,000	.013200	.000367	.....	.....	
11,800	59,000	.014000	.000800	.....	.....	
12,000	60,000	.014933	.000933	.....	.....	
12,460	62,000	.016667	.001734	.....	.....	
12,800	64,000	.018667	.002000	.....	.....	
13,200	66,000	.020667	.002000	.....	.....	
13,600	68,000	.023000	.002333	.....	.....	
14,000	70,000	.025167	.002167	.....	.....	
14,400	72,000	.027667	.002500	.....	.....	
14,800	74,000	.030167	.002500	.....	.....	
15,200	76,000	.032833	.002666	.....	.....	
15,600	78,000	.036000	.003167	.....	.....	
16,000	80,000	.039667	.003667	.....	.....	
16,800	84,000	.048333	.008666	.....	.....	
17,600	88,000	.0633	.014967	.....	.....	
18,400	92,000	.0767	.0134	.....	.....	
19,200	96,000	.1100	.0333	.....	.....	
19,510	97,550	.1533	.0433	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	97,550
Elastic limit per square inch of original section	do...	57,000
Elongation per inch after rupture	inch..	.2133
Elongation per inch under strain at elastic limit	do...	.002000
Reduction in diameter at point of rupture	do...	.095
Reduction in area after rupture, per cent of original section		34.0
Position of rupture		1".5 from neck
Character of broken surface		silky, and fine granular metal interspersed
Elongation of inch sections		".19, ".31, ".14

No. 391, ROLLED, AND ANNEALED IN CHARCOAL.

No. 5363.

Marks, 391. Breech end.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001300	.000333	0.	.....	
12,500	50,000	.001633	.000333	0.	.....	
15,000	60,000	.001967	.000334	0.	.....	
15,250	61,000	.002000	.000033	.....	.....	
15,500	62,000	.002067	.000067	.....	.....	Elastic limit.
						Load fell.
14,000	56,000	.004167	.002100	.....	.....	
14,250	57,000	.007333	.003166	.....	.....	
14,500	58,000	.011333	.004000	.....	.....	
14,750	59,000	.012667	.001334	.....	.....	
15,000	60,000	.013333	.000666	.....	.....	
15,250	61,000	.013733	.000400	.....	.....	
15,500	62,000	.014400	.000667	.....	.....	
16,000	64,000	.016567	.002167	.....	.....	
16,500	66,000	.018333	.001766	.....	.....	
17,000	68,000	.020967	.002634	.....	.....	
17,500	70,000	.023000	.002033	.....	.....	
18,000	72,000	.024933	.001933	.....	.....	
18,500	74,000	.027333	.002400	.....	.....	
19,000	76,000	.030500	.003167	.....	.....	
19,500	78,000	.033333	.002833	.....	.....	
20,000	80,000	.036267	.002934	.....	.....	
21,000	84,000	.044000	.007733	.....	.....	
22,000	88,000	.053000	.009000	.....	.....	
23,000	92,000	.0667	.0137	.....	.....	
24,000	96,000	.0933	.0266	.....	.....	
24,760	99,040	.1500	.0567	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	99,040
Elastic limit per square inch of original section	do...	62,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.002067
Reduction in diameter at point of rupture	do...	.184
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1".24 from neck
Character of broken surface		silky, and fine granular metal interspersed
Elongation of inch sections		".14, ".31*, ".24*

No. 5364.

Marks, 391. Muzzle end.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000633	.000533	.....	.....	
4,000	20,000	.000633	0.	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001300	.000333	.....	.....	
10,000	50,000	.001667	.000367	0.	.....	
12,000	60,000	.002033	.000366	.000033	.000033	
13,000	65,000	.002167	.000134	.....	.....	
13,200	66,000	.002233	.000066	.....	.....	
13,400	67,000	.002267	.000034	.....	.....	Elastic limit.
						Load fell.
12,000	60,000	.004067	.001800	.....	.....	
12,200	61,000	.004667	.000600	.....	.....	
12,400	62,000	.007333	.002666	.....	.....	
12,600	63,000	.013267	.005934	.....	.....	
12,800	64,000	.013667	.000400	.....	.....	
13,000	65,000	.014167	.000500	.....	.....	
13,200	66,000	.015333	.001166	.....	.....	
13,600	68,000	.016500	.001167	.....	.....	
14,000	70,000	.018500	.002000	.....	.....	
14,400	72,000	.020400	.001900	.....	.....	
14,800	74,000	.022667	.002267	.....	.....	
15,200	76,000	.025000	.002333	.....	.....	
15,600	78,000	.027167	.002167	.....	.....	
16,000	80,000	.029833	.002666	.....	.....	
16,800	84,000	.035333	.005500	.....	.....	
17,000	88,000	.042333	.007000	.....	.....	
18,800	94,000	.0600	.017667	.....	.....	
19,600	98,000	.0733	.0133	.....	.....	
20,000	100,000	.0867	.0134	.....	.....	
20,700	103,500	.1500	.0633	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	103,500
Elastic limit per square inch of original section	do...	67,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.002267
Reduction in diameter at point of rupture	do...	.135
Reduction in area after rupture, per cent of original section		46.2
Position of rupture		".95 from neck
Character of broken surface		fine silky
Elongation of inch sections		".14, ".19, ".37"

ADDITIONAL SPECIMENS.

No. 5373.

Marks, 391. Muzzle second.
Diameter, ".564.
Sectional area, .25" square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.001000	.000367	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001733	.000366	0.	.....	
12,000	60,000	.002133	.000400	0.	.....	
12,000	60,000	.002133	0.	.....	.....	
.....	60,000	.002133	0.	.....	.....	After 10 minutes.
12,200	61,000	.002167	.000034	.....	.....	
12,400	62,000	.002233	.000066	.....	.....	
.....	62,000	.002233	0.	.....	.....	After 20 minutes.
12,600	63,000	.002300	.000067	.....	.....	Elastic limit.
12,600	63,000	.....	.....	.....	.....	Sustained 1½ minutes; then load fell.
11,800	59,000	.003267	.000967	.....	.....	
.....	59,000	.003667	.000400	.....	.....	After 6 minutes.
.....	59,000	.003933	.000266	.....	.....	After 10 minutes.
12,000	60,000	.004167	.000234	.....	.....	
12,200	61,000	.006667	.002500	.....	.....	
12,400	62,000	.013667	.007000	.....	.....	
12,600	63,000	.014533	.000866	.....	.....	
12,800	64,000	.014733	.000200	.....	.....	
13,200	66,000	.016500	.001767	.....	.....	
13,600	68,000	.018667	.002167	.....	.....	
14,000	70,000	.021067	.002400	.....	.....	
14,460	72,300	.022367	.001300	.....	.....	
14,800	74,000	.024333	.001966	.....	.....	
15,200	76,000	.027067	.002734	.....	.....	
15,600	78,000	.029733	.002666	.....	.....	
16,000	80,000	.032500	.002767	.....	.....	
16,800	84,000	.039000	.006500	.....	.....	
17,600	88,000	.047500	.008500	.....	.....	
18,400	92,000	.0567	.0092	.....	.....	
19,200	96,000	.0733	.0166	.....	.....	
20,000	100,000	.0967	.0234	.....	.....	
20,400	102,000	.1533	.0566	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	102,000
Elastic limit per square inch of original section	do...	63,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.002300
Reduction in diameter at point of rupture	do...	.135
Reduction in area after rupture, per cent of original section		46.2
Position of rupture		1".60 from neck
Character of broken surface		fine silky
Elongation of inch sections		".15, ".36*, ".17

No. 5374.

Marks, 391. Breech second.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001300	.000333	.....	.....	
10,000	50,000	.001667	.000367	0.	.....	
12,000	60,000	.002033	.000366	0.	.....	
.....	60,000	.002033	0.	.....	.....	
.....	60,000	.002033	0.	.....	.....	Elastic limit.
						Sustained load 6 minutes, then load fell.
11,000	55,000	.003300	.000267	.....	.....	
.....	55,000	.003633	.000333	.....	.....	After 1 hour.
11,200	56,000	.003700	.000067	.....	.....	
11,400	57,000	.003867	.000167	.....	.....	
11,600	58,000	.007300	.003433	.....	.....	
11,800	59,000	.010333	.003033	.....	.....	
12,000	60,000	.012933	.002600	.....	.....	
12,400	62,000	.014000	.001067	.....	.....	
12,800	64,000	.016167	.002167	.....	.....	
13,200	66,000	.018433	.002266	.....	.....	
13,600	68,000	.020167	.001734	.....	.....	
14,000	70,000	.022333	.002166	.....	.....	
14,400	72,000	.024667	.002334	.....	.....	
14,800	74,000	.027000	.002333	.....	.....	
15,200	76,000	.029333	.002333	.....	.....	
15,600	78,000	.032000	.002667	.....	.....	
16,000	80,000	.035667	.003667	.....	.....	
16,800	84,000	.043333	.007666	.....	.....	
17,600	88,000	.052000	.008667	.....	.....	
18,400	92,000	.0667	.0147	.....	.....	
19,200	96,000	.0867	.0200	.....	.....	
19,940	99,700	.1533	.0666	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	99,700
Elastic limit per square inch of original section	do...	60,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.002033
Reduction in diameter at point of rupture	do...	.135
Reduction in area after rupture, per cent of original section		46.2
Position of rupture		".9 from neck
Character of broken surface		fine silky
Elongation of inch sections		".14, ".17, ".34"

No. 392, Rolled and Annealed in Air.

No. 5365.

Marks, 392. Breech end.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads. Total.	Applied loads. Per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000123	.000123	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
12,500	50,000	.001667	.000334	0.	.....	
15,000	60,000	.002000	.000333	0.	.....	
15,250	61,000	.002033	.000033	.....	.....	
15,500	62,000	.002067	.000034	.....	.....	
15,750	63,000	.002100	.000033	.....	.....	
16,000	64,000	.002133	.000033	.....	.....	Elastic limit. Load fell.
14,250	57,000	.004200	.002167	.....	.....	
14,500	58,000	.005667	.001367	.....	.....	
14,750	59,000	.008333	.002666	.....	.....	
15,000	60,000	.011667	.003334	.....	.....	
15,250	61,000	.013200	.001533	.....	.....	
15,500	62,000	.013700	.000500	.....	.....	
15,750	63,000	.014033	.000333	.....	.....	
16,000	64,000	.014700	.000667	.....	.....	
16,500	66,000	.016767	.001067	.....	.....	
17,000	68,000	.018600	.001833	.....	.....	
17,500	70,000	.021000	.002400	.....	.....	
18,000	72,000	.023000	.002000	.....	.....	
18,500	74,000	.025500	.002500	.....	.....	
19,000	76,000	.028333	.002833	.....	.....	
19,500	78,000	.030833	.002500	.....	.....	
20,000	80,000	.033333	.002500	.....	.....	
21,000	84,000	.040500	.007167	.....	.....	
22,000	88,000	.0533	.0128	.....	.....	
23,000	92,000	.0633	.0100	.....	.....	
24,000	96,000	.0800	.0167	.....	.....	
25,000	100,000	.1200	.0400	.....	.....	
25,090	100,360	.1467	.0267	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	100,360
Elastic limit per square inch of original section	do...	64,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.002133
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1".49 from neck
Character of broken surface		fine silky
Elongation of inch sections		".15, ".36*, ".19

No. 5366.

Marks, 392. Muzzle end.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.		
2,000	10,000	.000300	.000200			
4,000	20,000	.000667	.000367			
6,000	30,000	.001000	.000333			
8,000	40,000	.001333	.000333			
10,000	50,000	.001700	.000367	0.		
12,000	60,000	.002033	.000333	0.		
13,000	65,000	.002200	.000167			
13,200	66,000	.002267	.000067			
13,400	67,000	.002300	.000033			Elastic limit. Load fell.
12,200	61,000	.003833	.001533			
12,400	62,000	.004333	.000500			
12,600	63,000	.005500	.001167			
12,800	64,000	.012667	.007167			
13,200	66,000	.015733	.003066			
13,600	68,000	.017667	.001934			
14,000	70,000	.019167	.001500			
14,400	72,000	.021333	.002166			
14,800	74,000	.023833	.002500			
15,200	76,000	.025667	.001834			
15,600	78,000	.028333	.002666			
16,000	80,000	.031333	.003000			
16,800	84,000	.037933	.006600			
17,600	88,000	.045333	.007400			
18,400	92,000	.0567	.011367			
19,200	96,000	.0733	.0166			
20,000	100,000	.0967	.0234			
20,380	101,900	.1467	.0500			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	101,900
Elastic limit per square inch of original section	do...	67,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.002300
Reduction in diameter at point of rupture	do...	.135
Reduction in area after rupture, per cent of original section		46.2
Position of rupture		"1.5 from neck
Character of broken surface		fine silky
Elongation of inch sections		".14, ".37*, ".17

ADDITIONAL SPECIMENS.

Annealed at Watertown Arsenal by heating to a low cherry red and cooling in lime.

No. 5375.

Marks, 392. Muzzle second.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.001000	.000367	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001667	.000334	0.	.....	
12,000	60,000	.002033	.000366	.....	.....	
13,000	65,000	.002200	.000167	.....	.....	Elastic limit.
						Load fell.
11,600	58,000	.002667	.001667	.....	.....	
11,800	59,000	.004267	.000500	.....	.....	
12,000	60,000	.006333	.002066	.....	.....	
12,200	61,000	.014067	.005734	.....	.....	
12,400	62,000	.014667	.000600	.....	.....	
12,600	63,000	.015667	.001000	.....	.....	
12,800	64,000	.016267	.000700	.....	.....	
13,000	65,000	.017500	.001133	.....	.....	
13,200	66,000	.018833	.001333	.....	.....	
13,600	68,000	.020333	.001500	.....	.....	
14,000	70,000	.023000	.002667	.....	.....	
14,400	72,000	.025000	.002000	.....	.....	
14,800	74,000	.027500	.002500	.....	.....	
15,200	76,000	.030333	.002833	.....	.....	
15,600	78,000	.033333	.003000	.....	.....	
16,000	80,000	.036500	.003167	.....	.....	
16,800	84,000	.044667	.008167	.....	.....	
17,600	88,000	.0567	.012033	.....	.....	
18,400	92,000	.0700	.0133	.....	.....	
19,200	96,000	.0967	.0267	.....	.....	
19,770	98,850	.1467	.0500	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	98,850
Elastic limit per square inch of original section	do...	65,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.002200
Reduction in diameter at point of rupture	do...	.145
Reduction in area after rupture, per cent of original section		49.1
Position of rupture		".8 from neck
Character of broken surface		fine silky
Elongation of inch sections		".14, ".16, ".38*

No. 5376.

Marks, 392. Breech second.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	.....	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.001000	.000367	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001700	.000367	0.	.....	
12,000	60,000	.002033	.000333	0.	.....	Elastic limit.
12,000	60,000	.....	.....	.....	.....	Load fell on second application.
10,600	53,000	.006667	.004634	.....	.....	
10,800	54,000	.007667	.001000	.....	.....	
11,000	55,000	.010333	.002666	.....	.....	
11,200	56,000	.013333	.003000	.....	.....	
11,600	58,000	.015000	.001667	.....	.....	
12,000	60,000	.017033	.002033	.....	.....	
12,400	62,000	.018767	.001734	.....	.....	
12,800	64,000	.021167	.002400	.....	.....	
13,200	66,000	.023433	.002266	.....	.....	
13,600	68,000	.026000	.002567	.....	.....	
14,000	70,000	.028500	.002500	.....	.....	
14,400	72,000	.030500	.002000	.....	.....	
14,800	74,000	.035000	.004500	.....	.....	
15,200	76,000	.038333	.003333	.....	.....	
15,600	78,000	.042667	.004334	.....	.....	
16,000	80,000	.046667	.004000	.....	.....	
16,800	84,000	.060000	.013333	.....	.....	
17,600	88,000	.0767	.0167	.....	.....	
18,400	92,000	.1067	.0300	.....	.....	
18,730	93,650	.1600	.0533	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	93,650
Elastic limit per square inch of original section	do...	60,000
Elongation per inch after rupture	inch..	.2433
Elongation per inch under strain at elastic limit	do...	.002033
Reduction in diameter at point of rupture	do...	.155
Reduction in area after rupture, per cent of original section		51.9
Position of rupture		at middle of stem
Character of broken surface		fine silky
Elongation of inch sections		".16, ".41", ".16

No. 393, Rolled, Reheated in Coal Furnace, and Annealed in Charcoal.

No. 5367.

Marks, 393. Breech end.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.		
2,500	10,000	.000300	.000167			
5,000	20,000	.000633	.000333			
7,500	30,000	.000967	.000334			
10,000	40,000	.001333	.000366	0.		
12,500	50,000	.001667	.000334	0.		
13,750	55,000	.001833	.000166			
14,000	56,000	.001867	.000034			
14,250	57,000	.001900	.000033			
14,500	58,000	.001967	.000067			
14,750	59,000	.002100	.000033			Elastic limit.
						Load fell.
13,250	53,000	.003500	.001500			
13,500	54,000	.004300	.000800			
13,750	55,000	.005467	.001167			
14,000	56,000	.006333	.002866			
14,250	57,000	.011767	.003434			
14,500	58,000	.012500	.000733			
14,750	59,000	.013333	.000833			
15,000	60,000	.014100	.000767			
15,500	62,000	.016000	.001900			
16,000	64,000	.018000	.002000			
16,500	66,000	.020167	.002167			
17,000	68,000	.022067	.001900			
17,500	70,000	.024667	.002600			
18,000	72,000	.027000	.002333			
18,500	74,000	.029667	.002667			
19,000	76,000	.032667	.003000			
19,500	78,000	.035500	.002833			
20,000	80,000	.039333	.003833			
21,000	84,000	.047667	.008334			
22,000	88,000	.0600	.012333			
23,000	92,000	.0767	.0167			
24,000	96,000	.1067	.0300			
24,300	97,200	.1467	.0400			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	97,200
Elastic limit per square inch of original section	do...	59,000
Elongation per inch after rupture	inch..	.2233
Elongation per inch under strain at elastic limit	do...	.002000
Reduction in diameter at point of rupture	do...	.184
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1".7 from neck
Character of broken surface		silky, and fine granular metal interspersed
Elongation of inch sections		".18, ".37*, ".15

No. 5368.

Marks, 393. Muzzle end.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001700	.000367	.000033	.000033	
11,000	55,000	.001900	.000200	.....	.....	
11,200	56,000	.001933	.000033	.....	.....	
11,400	57,000	.002000	.000067	.....	.....	Elastic limit.
						Load fell.
10,200	51,000	.004100	.002100	.....	.....	
10,400	52,000	.004633	.000533	.....	.....	
10,600	53,000	.006500	.001867	.....	.....	
10,800	54,000	.010167	.003667	.....	.....	
11,000	55,000	.011000	.000833	.....	.....	
11,200	56,000	.011700	.000700	.....	.....	
11,600	58,000	.013667	.001967	.....	.....	
12,000	60,000	.015000	.001333	.....	.....	
12,400	62,000	.016667	.001667	.....	.....	
12,800	64,000	.018667	.002000	.....	.....	
13,200	66,000	.021000	.002333	.....	.....	
13,600	68,000	.023167	.002167	.....	.....	
14,000	70,000	.025667	.002500	.....	.....	
14,400	72,000	.027667	.002000	.....	.....	
14,800	74,000	.030333	.002666	.....	.....	
15,200	76,000	.033000	.002667	.....	.....	
15,600	78,000	.036167	.003167	.....	.....	
16,000	80,000	.039667	.003500	.....	.....	
16,800	84,000	.048333	.008666	.....	.....	
17,600	88,000	.0633	.014967	.....	.....	
18,400	92,000	.0800	.0167	.....	.....	
19,200	96,000	.1167	.0367	.....	.....	
19,310	96,550	.1467	.0300	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	96,550
Elastic limit per square inch of original section	do...	57,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.002000
Reduction in diameter at point of rupture	do...	.095
Reduction in area after rupture, per cent of original section		34.0
Position of rupture		1". 24 from neck
Character of broken surface		silky, interspersed with fine granular metal
Elongation of inch sections		".24, ".24, ".14

No. 394, Rolled. Cooled in Air, Heated in Gas Furnace, and Annealed in Charcoal.

No. 5369.

Marks, 394. Breech end.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000123	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
10,000	40,000	.001400	.000367	0.	.....	
12,500	50,000	.001700	.000300	0.	.....	
13,500	54,000	.001833	.000133	.....	.....	
13,750	55,000	.001867	.000034	.....	.....	Elastic limit.
						Load fell.
12,500	50,000	.004000	.002133	.....	.....	
12,750	51,000	.004333	.000333	.....	.....	
13,000	52,000	.005667	.001334	.....	.....	
13,250	53,000	.008667	.003000	.....	.....	
13,500	54,000	.010000	.001333	.....	.....	
13,750	55,000	.010767	.000767	.....	.....	
14,000	56,000	.011600	.000833	.....	.....	
14,250	57,000	.012400	.000800	.....	.....	
14,500	58,000	.013333	.000933	.....	.....	
14,750	59,000	.014167	.000834	.....	.....	
15,000	60,000	.015300	.001133	.....	.....	
15,500	62,000	.017300	.002000	.....	.....	
16,000	64,000	.019367	.002067	.....	.....	
16,500	66,000	.021667	.002300	.....	.....	
17,000	68,000	.023667	.002000	.....	.....	
17,500	70,000	.026000	.002333	.....	.....	
18,000	72,000	.028633	.002633	.....	.....	
18,500	74,000	.031500	.002867	.....	.....	
19,000	76,000	.034400	.002900	.....	.....	
19,500	78,000	.037667	.003267	.....	.....	
20,000	80,000	.041333	.003666	.....	.....	
21,000	84,000	.0500	.008667	.....	.....	
22,000	88,000	.0633	.0133	.....	.....	
23,000	92,000	.0867	.0234	.....	.....	
23,920	95,680	.1500	.0633	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,680
Elastic limit per square inch of original section	do...	55,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.001867
Reduction in diameter at point of rupture	do...	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		1" from neck
Character of broken surface		silky center, fine granular at the circumference
Elongation of inch sections		".14, ".21, ".27

No. 5370.

Marks, 394. Muzzle end.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000333	.000233	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001700	.000333	.....	.....	
11,000	55,000	.001900	.000200	.....	.....	
11,200	56,000	.001967	.000067	.....	.....	
11,400	57,000	.002000	.000033	.....	.....	
11,600	58,000	.002000	0.	.....	.....	
11,800	59,000	.002033	.000033	.....	.....	Elastic limit.
						Load fell.
10,600	53,000	.003867	.001834	.....	.....	
10,800	54,000	.004367	.000500	.....	.....	
11,000	55,000	.005333	.000966	.....	.....	
11,200	56,000	.007833	.002500	.....	.....	
11,600	58,000	.011667	.003834	.....	.....	
12,000	60,000	.015000	.003333	.....	.....	
12,400	62,000	.016667	.001667	.....	.....	
12,800	64,000	.018333	.001666	.....	.....	
13,200	66,000	.020667	.002334	.....	.....	
13,600	68,000	.022667	.002000	.....	.....	
14,000	70,000	.025333	.002666	.....	.....	
14,400	72,000	.027667	.002334	.....	.....	
14,800	74,000	.031333	.003666	.....	.....	
15,200	76,000	.034367	.003034	.....	.....	
16,000	80,000	.040667	.006300	.....	.....	
16,800	84,000	.049667	.009000	.....	.....	
17,600	88,000	.0633	.013633	.....	.....	
18,400	92,000	.0800	.0167	.....	.....	
19,200	96,000	.1200	.0400	.....	.....	
19,340	96,700	.1467	.0267	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	96,700
Elastic limit per square inch of original section	do...	59,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.002033
Reduction in diameter at point of rupture	do...	.095
Reduction in area after rupture, per cent of original section		34.0
Position of rupture		1″.25 from neck
Character of broken surface		silky, and fine granular metal interspersed
Elongation of inch sections		″.15, ″.25*, ″.23*

ADDITIONAL SPECIMENS.

Reannealed at Watertown Arsenal by heating to a low cherry color and cooling in lime.

No. 5377.

Marks, 394. Breech second.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000267	.000167	.....	.....	
4,000	20,000	.000600	.000333	.....	.....	
6,000	30,000	.000900	.000300	.....	.....	
8,000	40,000	.001233	.000333	.....	.....	
10,000	50,000	.001567	.000334	0.	.....	
11,000	55,000	.001700	.000133	.....	.....	
11,600	58,000	.001833	.000133	.....	.....	Elastic limit.
						Load fell.
11,000	55,000	.003467	.001634	.....	.....	
11,200	56,000	.004500	.001033	.....	.....	
11,400	57,000	.006500	.002000	.....	.....	
11,600	58,000	.008667	.002167	.....	.....	
11,800	59,000	.009667	.001000	.....	.....	
12,000	60,000	.010500	.000833	.....	.....	
12,400	62,000	.012000	.001500	.....	.....	
12,800	64,000	.013500	.001500	.....	.....	
13,200	66,000	.015000	.001500	.....	.....	
13,600	68,000	.017000	.002000	.....	.....	
14,000	70,000	.018667	.001667	.....	.....	
14,400	72,000	.020667	.002000	.....	.....	
14,800	74,000	.022667	.002000	.....	.....	
15,200	76,000	.024667	.002000	.....	.....	
15,600	78,000	.027000	.002333	.....	.....	
16,000	80,000	.029333	.002333	.....	.....	
16,800	84,000	.035000	.005667	.....	.....	
17,600	88,000	.041667	.006667	.....	.....	
18,400	92,000	.049333	.007666	.....	.....	
19,280	96,400	.0600	.010667	.....	.....	
20,000	100,000	.0800	.0200	.....	.....	
20,800	104,000	.1133	.0333	.....	.....	
20,990	104,950	.1467	.0334	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	104,950
Elastic limit per square inch of original section	do...	58,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.001833
Reduction in diameter at point of rupture	do...	.085
Reduction in area after rupture, per cent of original section		30.7
Position of rupture		1".4 from neck
Character of broken surface		silky center, granular at circumference
Elongation of inch sections		".21 ".29*, ".15

No. 5378.

Marks, 394. Muzzle second.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000267	.000167	.....	.....	
4,000	20,000	.000567	.000300	.....	.....	
6,000	30,000	.000900	.000333	.....	.....	
8,000	40,000	.001233	.000333	.....	.....	
10,000	50,000	.001500	.000267	.....	.....	
11,000	55,000	.001667	.000167	.....	.....	
12,000	60,000	.001767	.000100	.....	.....	
12,200	61,000	.001800	.000033	.....	.....	Elastic limit Load fell.
11,400	57,000	.004000	.002200	.....	.....	
11,600	58,000	.006167	.002167	.....	.....	
11,800	59,000	.009000	.002833	.....	.....	
12,000	60,000	.009633	.000633	.....	.....	
12,400	62,000	.011167	.001534	.....	.....	
12,800	64,000	.012667	.001500	.....	.....	
13,200	66,000	.014333	.001666	.....	.....	
13,600	68,000	.015833	.001500	.....	.....	
14,000	70,000	.017667	.001834	.....	.....	
14,400	72,000	.019333	.001666	.....	.....	
14,800	74,000	.021333	.002000	.....	.....	
15,200	76,000	.023333	.002000	.....	.....	
15,600	78,000	.025333	.002000	.....	.....	
16,000	80,000	.027500	.002167	.....	.....	
16,800	84,000	.032500	.005000	.....	.....	
17,600	88,000	.038000	.005500	.....	.....	
18,400	92,000	.045667	.007667	.....	.....	
19,200	96,000	.054667	.009000	.....	.....	
20,000	100,000	.0700	.015333	.....	.....	
20,800	104,000	.0900	.0200	.....	.....	
21,370	106,850	.1467	.0567	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	106,850
Elastic limit per square inch of original section	do...	61,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		23.9
Postion of rupture		1".24 from neck
Character of broken surface		fine granular, radiating from a silky spot at the circumference
Elongation of inch sections		".15, ".24", ".23"

No. 395, Rolled, Cooled in Air, Heated in Coal Furnace, and Annealed in Charcoal.

No. 5371.

Marks, 395. Breech end.
Diameter, ".564.
Sectional area, .25 square inch.
Ganged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	.....	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001333	.000333	.....	.....	
12,500	50,000	.001667	.000334	.....	.....	
15,000	60,000	.002033	.000366	.000033	.000033	Elastic limit.
15,000	60,000	.....	.....	.....	.....	Second application. Load fell.
13,500	54,000	.004833	.002800	.....	.....	
13,750	55,000	.006000	.001167	.....	.....	
14,000	56,000	.007333	.001333	.....	.....	
14,250	57,000	.009833	.002500	.....	.....	
14,500	58,000	.013100	.003267	.....	.....	
14,750	59,000	.013833	.000733	.....	.....	
15,000	60,000	.014667	.000834	.....	.....	
15,500	62,000	.016667	.002000	.....	.....	
16,000	64,000	.018500	.001833	.....	.....	
16,500	66,000	.020667	.002167	.....	.....	
17,000	68,000	.023067	.002400	.....	.....	
17,500	70,000	.025167	.002100	.....	.....	
18,000	72,000	.027667	.002500	.....	.....	
18,500	74,000	.030667	.003000	.....	.....	
19,000	76,000	.033333	.002666	.....	.....	
19,500	78,000	.037167	.003834	.....	.....	
20,000	80,000	.040000	.002833	.....	.....	
21,000	84,000	.050000	.010000	.....	.....	
22,000	88,000	.0633	.0133	.....	.....	
23,000	92,000	.0800	.0167	.....	.....	
24,000	96,000	.1133	.0333	.....	.....	
24,180	96,720	.1500	.0367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	96,720
Elastic limit per square inch of original section	do...	60,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.002033
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1" from neck
Character of broken surface		silky, and fine granular metal interspersed
Elongation of inch sections		".33*, ".19, ".18

No. 5372.

Marks, 395. Muzzle end.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001300	.000333	.....	.....	
10,000	50,000	.001633	.000333	.....	.....	
12,000	60,000	.002000	.000367	0.	.....	
12,200	61,000	.002033	.000033	.....	.....	Elastic limit.
						Load fell.
11,000	55,000	.003667	.001634	.....	.....	
11,200	56,000	.004167	.000500	.....	.....	
11,400	57,000	.005500	.001333	.....	.....	
11,600	58,000	.008000	.002500	.....	.....	
11,800	59,000	.012333	.004333	.....	.....	
12,000	60,000	.013667	.001334	.....	.....	
12,400	62,000	.015000	.001333	.....	.....	
12,800	64,000	.016667	.001667	.....	.....	
13,200	66,000	.018667	.002000	.....	.....	
13,600	68,000	.020667	.002000	.....	.....	
14,000	70,000	.023000	.002333	.....	.....	
14,400	72,000	.025000	.002000	.....	.....	
15,200	76,000	.031000	.006000	.....	.....	
16,000	80,000	.037000	.006000	.....	.....	
16,800	84,000	.045000	.008000	.....	.....	
17,600	88,000	.054000	.009000	.....	.....	
18,400	92,000	.0700	.0160	.....	.....	
19,200	96,000	.0900	.0200	.....	.....	
19,910	99,550	.1600	.0700	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	99,550
Elastic limit per square inch of original section	do...	61,000
Elongation per inch after rupture	inch..	.2233
Elongation per inch under strain at elastic limit	do...	.002033
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		at middle of stem
Character of broken surface		fine silky
Elongation of inch sections		".15, ".37*, ".15

TABULATION OF TENSION SPECIMENS TAKEN FROM PIECES OF STEEL WHICH HAVE BEEN ROLLED TO THE FORM OF RIFLE BARRELS (LENGTH OF STEMS 3″).

No. of test.	Mark on specimen.	Diameter.	Sectional area.	Elastic limit per square inch.	Ultimate strength per square inch.	Elongation in 8 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.	Treatment.
		Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Per ct.*	*Per cent.*		″ ″ ″	
5361	Breech, 39	.564	.25	57,000	95,640	21.7	39.2	Silky, and fine granular metal interspersed.	.33*, .18, .14	Reheated in gas furnace and annealed in charcoal.
5362	Muzzle, 39	.505	.25	57,000	97,550	21.3	34.0	do	.19, .31, .14	
5363	Breech, 391	.564	.25	62,000	99,040	23.0	41.9	do	.14, .31*, .24*	
5364	Muzzle, 391	.505	.20	67,000	103,500	23.3	46.2	Fine silky	.14, .19, .37*	Rolled and annealed in charcoal.
5373	Muzzle, second, 391	.564	.25	63,000	102,000	22.7	46.2	do	.15, .36*, .17	
5374	Breech, second, 391	.505	.20	60,000	99,700	21.7	46.2	do	.14, .17, .34*	
5365	Breech, 392	.564	.25	64,000	100,360	23.3	47.2	do	.15, .36*, .19	Rolled and annealed in air (simply cooled).
5366	Muzzle, 392	.505	.20	67,000	101,900	22.7	46.2	do	.14, .37*, .17	
5375	Muzzle, second, 392	.505	.20	65,000	98,350	22.7	49.1	do	.14, .16, .38*	Annealed at Watertown Arsenal by heating to a low cherry red and cooling in lime, after above treatment.
5376	Breech, second, 392	.564	.25	60,000	93,650	24.3	51.9	do	.16, .41*, .16	
5367	Breech, 393	.564	.25	59,000	97,200	23.3	41.9	Silky, and fine granular metal interspersed.	.18, .37*, .15	Rolled, reheated in coal furnace, and annealed in charcoal.
5368	Muzzle, 393	.505	.20	57,000	96,550	20.7	34.0	do	.24*, .24*, .14	
5369	Breech, 394	.564	.25	55,000	95,680	20.7	36.4	Silky center, fine granular at circumference.	.14, .31, .27*	Rolled, cooled in air, heated in gas furnace, and annealed in charcoal.
5370	Muzzle, 394	.505	.20	59,000	96,700	21.0	34.0	Silky, and fine granular metal interspersed.	.15, .25*, .23	
5377	Breech, second, 394	.505	.20	58,000	104,950	21.7	30.7	Silky center, granular at circumference.	.21, .29*, .15	Reannealed at Watertown Arsenal by heating to a low cherry color and cooling in lime.
5378	Muzzle, second, 394	.505	.20	61,000	106,850	20.7	23.9	Fine granular radiating from a silky spot at circumference.	.15, .24*, .23	
5371	Breech, 395	.564	.25	60,000	96,720	21.7	44.6	Silky, and fine granular metal, interspersed.	.33*, .19, .13	Rolled, cooled in air, heated in coal furnace, and annealed in charcoal.
5372	Muzzle, 395	.505	.20	61,000	99,550	22.3	43.3	Fine silky	.15, .37*, .15	

STEEL FOR RECEIVERS OF RIFLES, .30 CALIBER.

No. 5263.

Marks, 28 R.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	0.	.....	
10,000	40,000	.001333	.000333	0.	.....	
11,250	45,000	.001500	.000167	.....	.....	
11,500	46,000	.001533	.000033	.....	.....	
11,750	47,000	.001600	.000067	.....	.....	Elastic limit.
						Load fell.
10,250	41,000	.003067	.001467	.....	.....	
10,500	42,000	.003333	.000266	.....	.....	
		.004333	.001000	.....	.....	
10,750	43,000	.009500	.005167	.....	.....	
11,000	44,000	.011367	.001867	.....	.....	
11,250	45,000	.011600	.000233	.....	.....	
11,500	46,000	.012000	.000400	.....	.....	
11,750	47,000	.012667	.000667	.....	.....	
12,000	48,000	.014000	.001333	.....	.....	
12,250	49,000	.015000	.001000	.....	.....	
12,500	50,000	.016333	.001333	.....	.....	
13,000	52,000	.018633	.002300	.....	.....	
13,500	54,000	.020833	.002200	.....	.....	
14,000	56,000	.023667	.002834	.....	.....	
14,500	58,000	.026667	.003000	.....	.....	
15,000	60,000	.030167	.003500	.....	.....	
15,500	62,000	.0333	.003133	.....	.....	
16,000	64,000	.0367	.0034	.....	.....	
16,500	66,000	.0400	.0033	.....	.....	
17,000	68,000	.0467	.0067	.....	.....	
17,500	70,000	.0533	.0066	.....	.....	
18,000	72,000	.0600	.0067	.....	.....	
18,500	74,000	.0667	.0067	.....	.....	
19,000	76,000	.0800	.0133	.....	.....	
19,500	78,000	.0967	.0167	.....	.....	
20,000	80,000	.1300	.0333	.....	.....	
20,120	80,480	.1700	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	80,480
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2600
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1″.47 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.15, ″.40, ″.23

No. 5265.

Marks, N. S.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	0.	.....	
10,000	40,000	.001333	.000333	.....	.....	
11,250	45,000	.001500	.000167	.....	.....	
11,500	46,000	.001533	.000033	.....	.....	
11,750	47,000	.001600	.000067	.....	.....	Elastic limit.
12,000	48,000	.035000	.033400	.....	.....	
12,250	49,000	.037000	.002000	.....	.....	
12,500	50,000	.040000	.003000	.....	.....	
12,750	51,000	.042667	.002667	.....	.....	
13,000	52,000	.047333	.004666	.....	.....	
13,250	53,000	.050000	.002667	.....	.....	
13,500	54,000	.055000	.005000	.....	.....	
14,000	56,000	.0667	.0117	.....	.....	
14,500	58,000	.0767	.0100	.....	.....	
15,000	60,000	.0900	.0133	.....	.....	
15,000	62,000	.1133	.0233	.....	.....	
16,000	64,000	.1567	.0434	.....	.....	
16,120	64,480	.2033	.0466	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	64,480
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.3467
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.214
Reduction in area after rupture, per cent of original section		61.5
Position of rupture		at middle of stem
Character of broken surface		fine silky
Elongation of inch sections		".23, ".55*, ".26

For chemical analysis, see page 702.

No. 5275.

Marks, P. B.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	0.	.....	
8,750	35,000	.001200	.000167	.....	.....	
10,000	40,000	.001367	.000167	0.	.....	
11,250	45,000	.001567	.000200	.....	.....	Elastic limit.
11,500	46,000	.015500	.013933	.....	.....	
11,750	47,000	.016500	.001000	.....	.....	
12,000	48,000	.018000	.001500	.....	.....	
12,250	49,000	.018833	.000833	.....	.....	
12,500	50,000	.020500	.001667	.....	.....	
12,750	51,000	.022000	.001500	.....	.....	
13,000	52,000	.023667	.001667	.....	.....	
13,500	54,000	.027667	.004000	.....	.....	
14,000	56,000	.031333	.003666	.....	.....	
14,500	58,000	.035000	.003667	.....	.....	
15,000	60,000	.039000	.004000	.....	.....	
15,500	62,000	.044000	.005000	.....	.....	
16,000	64,000	.049667	.005667	.....	.....	
16,500	66,000	.057000	.007333	.....	.....	
17,000	68,000	.0667	.0097	.....	.....	
17,500	70,000	.0800	.0133	.....	.....	
18,000	72,000	.0900	.0100	.....	.....	
18,500	74,000	.1167	.0267	.....	.....	
18,860	75,440	.1700	.0533	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	75,440
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2833
Elongation per inch under strain at elastic limit	do...	.001567
Reduction in diameter at point of rupture	do...	.204
Reduction in area after rupture, per cent of original section		59.3
Position of rupture		1". 2 from neck
Character of broken surface		fine silky
Elongation of inch sections		".43", ".25, ".17

No. 5276.

Marks, P. B. F.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	0.	.....	
8,750	35,000	.001200	.000167	.....	.....	
10,000	40,000	.001367	.000167	.000033	.000033	
10,250	41,000	.001400	.000033	.....	.....	
10,500	42,000	.001433	.000033	.....	.....	
10,750	43,000	.001533	.000100	.....	.....	
11,000	44,000	.001600	.000067	.....	.....	Elastic limit.
11,250	45,000	.016333	.014733	.....	.....	
11,500	46,000	.018167	.001834	.....	.....	
11,750	47,000	.019000	.000833	.....	.....	
12,000	48,000	.020667	.001667	.....	.....	
12,250	49,000	.021767	.001100	.....	.....	
12,500	50,000	.023333	.001566	.....	.....	
13,000	52,000	.026333	.003000	.....	.....	
13,500	54,000	.030000	.003667	.....	.....	
14,000	56,000	.034000	.004000	.....	.....	
14,500	58,000	.038333	.004333	.....	.....	
15,000	60,000	.043000	.004667	.....	.....	
15,500	62,000	.048667	.005667	.....	.....	
16,000	64,000	.055333	.006666	.....	.....	
16,500	66,000	.062333	.007000	.....	.....	
17,000	68,000	.0767	.014367	.....	.....	
17,500	70,000	.0867	.0100	.....	.....	
18,000	72,000	.1033	.0166	.....	.....	
18,500	74,000	.1333	.0300	.....	.....	
18,680	74,720	.1933	.0600	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	74,720
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.2900
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1".6 from neck
Character of broken surface		fine silky
Elongation of inch sections		".22, ".42*, ".23

For chemical analysis, see page 702.

No. 5277.

Marks, 29 R.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*o unds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	.....	.....	
10,000	40,000	.001300	.000200	0.	.....	
11,250	45,000	.001467	.000167	.....	.....	
12,500	50,000	.001667	.000200	0.	.....	
12,750	51,000	.001700	.000033	.....	.....	
13,000	52,000	.001733	.000033	.....	.....	
13,250	53,000	.001767	.000034	.....	.....	Elastic limit.
						Load fell.
12,250	49,000	.005000	.003233	.....	.....	
		.007333	.002333	.....	.....	
12,500	50,000	.019667	.002334	.....	.....	
12,750	51,000	.020333	.000666	.....	.....	
13,000	52,000	.021400	.001067	.....	.....	
13,250	53,000	.023000	.001600	.....	.....	
13,500	54,000	.024500	.001500	.....	.....	
14,000	56,000	.028000	.003500	.....	.....	
14,500	58,000	.031333	.003333	.....	.....	
15,000	60,000	.036667	.005334	.....	.....	
15,500	62,000	.041000	.004333	.....	.....	
16,000	64,000	.048000	.007000	.....	.....	
16,500	66,000	.0567	.0087	.....	.....	
17,000	68,000	.0633	.0066	.....	.....	
17,500	70,000	.0700	.0067	.....	.....	
18,000	72,000	.0833	.0133	.....	.....	
18,500	74,000	.1000	.0167	.....	.....	
19,000	76,000	.1267	.0267	.....	.....	
19,240	76,960	.1767	.0500	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	76,960
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.2567
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1".75 from neck
Character of broken surface		fine silky. A longitudinal cavity about ".015 diameter, extended ".30 and ".40, respectively, in each direction from the fractured surface. This hole was near the axis of the specimen.
Elongation of inch sections		".22, ".39*, ".16

No. 5278.

Marks, 30 R.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.		
2,500	10,000	.000333	.000200			
5,000	20,000	.000667	.000334			
7,500	30,000	.001000	.000333			
10,000	40,000	.001367	.000367	0.		
10,250	41,000	.001400	.000033			
10,500	42,000	.001433	.000033			Elastic limit. Load fell.
9,000	36,000	.005333	.003900			
9,250	37,000	.008333	.003000			
9,500	38,000	.011500	.003167			
9,750	39,000	.027667	.016167			
10,000	40,000	.030333	.002666			
10,250	41,000	.032167	.001834			
10,500	42,000	.035000	.002833			
10,750	43,000	.038000	.003000			
11,000	44,000	.041667	.003667			
11,500	46,000	.050667	.009000			
12,000	48,000	.0633	.012633			
12,500	50,000	.0767	.0134			
13,000	52,000	.0867	.0100			
13,500	54,000	.1033	.0166			
14,000	56,000	.1300	.0267			
14,500	58,000	.2000	.0700			
14,560	58,240	.2300	.0300			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	58,240
Elastic limit per square inch of original section	do...	42,000
Elongation per inch after rupture	inch...	.3400
Elongation per inch under strain at elastic limit	do...	.001433
Reduction in diameter at point of rupture	do...	.234
Reduction in area after rupture, per cent of original section		65.8
Position of rupture		".75 from neck
Character of broken surface		fine silky, minute longitudinal cavity in fractured surface
Elongation of inch sections		".56*, ".34, ".22

TABULATION OF TENSION SPECIMENS FROM STEEL FOR RECEIVERS OF RIFLES (STEMS .3" LONG).

No. of test.	Mark on specimen.	Diameter.	Sectional area.	Elastic limit per square inch.	Ultimate strength per square inch.	Elongation in 8 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.		
		Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Per ct.*	*Per ct.*		"	"	"
5263	28 R	.564	.25	47,000	80,480	26	52.2	Fine silky ..	.15,	.40*,	.23
5265	N. S.	.564	.25	47,000	64,480	34.7	61.5	.....do	.23,	.55*,	.26
5275	P. B	.564	.25	45,000	75,440	28.3	59.3	.....do	.43*,	.25,	.17
5276	P. B. F.	.564	.25	44,000	74,720	29	49.7	.....do	.22,	.42*,	.23
5277	29 R	.564	.25	53,000	76,960	25.7	47.2	.....do	.22,	.39*,	.16
5278	30 R	.564	.25	42,000	58,240	34	65.8	.....do	.56*,	.24,	.22

12-INCH GUN LIFT.

STEEL FROM TOP CARRIAGE CASTING.

No. 5303.

Marks, $^{12\ C_1 Te}_{T_2 M}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
3,800	19,000	.000700	.000400	.....	.....	Elastic limit.
4,000	20,000	.000900	.000200	.000150	.000150	
5,000	25,000	.003500	.002600	.002600	.002450	
5,200	26,000	.004600	.001100	.....	.....	
5,400	27,000	.005500	.000900	.....	.....	
5,600	28,000	.006650	.001150	.....	.....	
5,800	29,000	.007750	.001100	.....	.....	
6,000	30,000	.009500	.001750	.008400	.005800	
6,200	31,000	.010010	.000510	.....	.....	
6,400	32,000	.011900	.001890	.....	.....	
6,600	33,000	.013450	.001550	.....	.....	
6,800	34,000	.014750	.001300	.....	.....	
7,000	35,000	.016250	.001500	.....	.....	
7,200	36,000	.017900	.001650	.....	.....	
7,400	37,000	.019600	.001700	.....	.....	
7,600	38,000	.021100	.001500	.....	.....	
7,800	39,000	.023150	.002050	.....	.....	
8,000	40,000	.025000	.001850	.023450	.015050	
8,400	42,000	.0300	.0050	.....	.....	
8,800	44,000	.0350	.0050	.....	.....	
9,200	46,000	.0450	.0100	.....	.....	
9,600	48,000	.0500	.0050	.....	.....	
10,000	50,000	.0550	.0050	.....	.....	
10,400	52,000	.0650	.0100	.....	.....	
10,800	54,000	.0750	.0100	.....	.....	
11,200	56,000	.0900	.0150	.....	.....	
11,600	58,000	.1050	.0150	.....	.....	
12,000	60,000	.1350	.0300	.....	.....	
12,270	61,350	.1950	.0600	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	61,350
Elastic limit per square inch of original section	do...	19,000
Elongation per inch after rupture	inch..	.2700
Elongation per inch under strain at elastic limit	do...	.000700
Reduction in diameter at point of rupture	do..	.115
Reduction in area after rupture, per cent of original section		40.3
Position of rupture		1″.17 from neck
Character of broken surface		dull silky
Elongation of inch sections		″.25, ″.29*

No. 5304.

Marks, $\frac{12\ C_1\ To}{T,\ M}$
Diameter, ".505.
Sectional, area, .20 square inch.
Gauged length, 2".

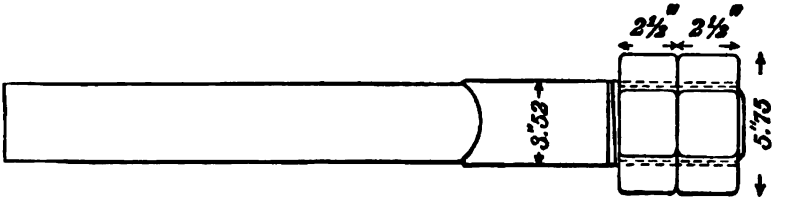
Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000050	.000050	0.	.....	
2,000	10,000	.000150	.000100	.....	.....	
3,000	15,000	.000400	.000250	0.	.....	
4,000	20,000	.000650	.000250	0.	.....	
4,200	21,000	.000650	0.	.....	.....	
4,400	22,000	.000700	.000050	.....	.....	
4,600	23,000	.000750	.000050	.....	.....	Elastic limit.
4,800	24,000	.001050	.000300	.....	.....	
5,000	25,000	.001350	.000300	.000600	.000600	
5,200	26,000	.001750	.000400	.....	.....	
5,400	27,000	.002250	.000500	.....	.....	
5,600	28,000	.003000	.000750	.....	.....	
5,800	29,000	.003750	.000750	.....	.....	
6,000	30,000	.004900	.001150	.003700	.003100	
6,200	31,000	.005450	.000550	.....	.....	
6,400	32,000	.006550	.001100	.....	.....	
6,700	33,000	.007600	.001050	.....	.....	
6,800	34,000	.008600	.001000	.....	.....	
7,000	35,000	.009650	.001050	.....	.....	
7,200	36,000	.010550	.000900	.....	.....	
7,400	37,000	.011950	.001400	.....	.....	
7,600	38,000	.013000	.001050	.....	.....	
7,800	39,000	.014300	.001300	.....	.....	
8,000	40,000	.015500	.001200	.014100	.010400	
8,400	42,000	.0200	.0045	.....	.....	
8,800	44,000	.0250	.0050	.....	.....	
9,200	46,000	.0300	.0050	.....	.....	
9,600	48,000	.0300+	0.	.....	.....	
10,000	50,000	.0350	.0050	.....	.....	
10,400	52,000	.0400	.0050	.....	.....	
10,800	54,000	.0450	.0050	.....	.....	
11,200	56,000	.0500	.0050	.....	.....	
11,600	58,000	.0600	.0100	.....	.....	
12,000	60,000	.0650	.0050	.....	.....	
12,400	62,000	.0750	.0100	.....	.....	
12,800	64,000	.0900	.0150	.....	.....	
12,980	64,900	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	64,900
Elastic limit per square inch of original section	do....	23,000
Elongation per inch after rupture	inch..	.1150
Elongation per inch under strain at elastic limit	do...	.000750
Reduction in diameter at point of rupture	do...	.625
Reduction in area after rupture, per cent of original section		9.5
Position of rupture		".55 from neck
Character of broken surface		coarse granular
Elongation of inch sections		".11", ".12

TEST OF A BAR REPRESENTING THE THREADED END OF A PISTON ROD FOR THE RECOIL CYLINDER OF A 12-INCH B. L. RIFLE BARBETTE CARRIAGE.

No. 7826.



Diameter at root of thread, 3".14.

Sectional area of stem, 9.73 square inches.

Sectional area at root of thread, 7.74 square inches.

A total load of 500,000 pounds tension was applied to the piston rod, which was sustained by the nuts on the threaded end in the same manner as this end of the rod is strained in service.

The first indications of permanent sets occurred under a load of 350,000 pounds.

The total elongation after completion of the test was ".05 measured on a section 6" long, of which 4½" was over the threaded section and 1½" over the plain section of the stem.

Maximum stress on stem, 51,390 pounds per square inch.

Maximum stress at root of thread, 64,600 pounds per square inch.

SPECIMEN OF STEEL FROM END OF GUN-LEVER AXLE FOR 8-INCH DISAPPEARING CARRIAGE.

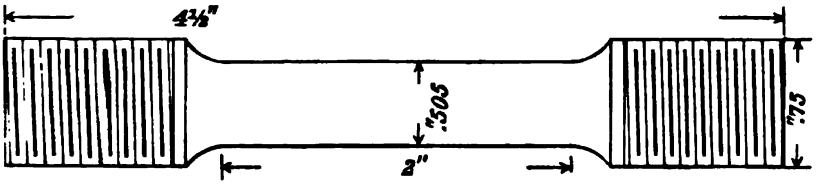
No. 7828.

Diameter, ".564.
Sectional area, .25 square inch.
Elastic limit, 12,800 pounds=51,200 pounds per square inch.
Tensile strength, 26,380 pounds=105,520 pounds per square inch.
Elongation in 3 inches, ".20=6.7 per cent.
Elongation of inch sections, ".06, ".08*, "06.
Diameter at fracture, ".54; area, .229 square inch.
Contraction of area, 8.4 per cent.
Appearance of fracture, coarse granular, silvery.

TENSION TESTS OF STEEL SPECIMENS FOR THE PURPOSE OF STANDARDIZING THE TESTING MACHINE OF THE KILBY MANUFACTURING COMPANY, OF CLEVELAND, OHIO.

[Specimens marked H L_7 and S L_7 had previously been pulled at the Kilby Manufacturing Co's. works.]

Form of specimens.



No. 5329.

Marks, H L_2.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	0.	.....	
2,000	10,000	.000350	.000200	.....	.....	
3,000	15,000	.000500	.000150	.....	.....	
4,000	20,000	.000700	.000200	.....	.....	
5,000	25,000	.000900	.000200	.....	.....	
6,000	30,000	.001050	.000150	0.	.....	
7,000	35,000	.001300	.000250	.....	.....	
8,000	40,000	.001500	.000200	.000050	.000050	Elastic limit.
8,200	41,000	.006550	.005050	.....	.....	
8,400	42,000	.007250	.000700	.....	.....	
8,600	43,000	.008400	.001150	.....	.....	
8,800	44,000	.009000	.000600	.....	.....	
9,000	45,000	.009900	.000900	.....	.....	
10,000	50,000	.013400	.003500	.....	.....	
11,000	55,000	.017550	.004150	.....	.....	
12,000	60,000	.021900	.004350	.....	.....	
13,000	65,000	.027050	.005150	.....	.....	
14,000	70,000	.033950	.006900	.....	.....	
15,000	75,000	.042450	.008500	.....	.....	
16,000	80,000	.054950	.012500	.....	.....	
17,000	85,000	.0750	.020050	.....	.....	
18,000	90,000	.1350	.0600	.....	.....	
18,110	90,550	.1750	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,550
Elastic limit per square inch of original section	do...	40,000
Elongation per inch after rupture	inch..	.2450
Elongation per inch under strain at elastic limit	do...	.001500
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section	do...	37.1
Position of rupture		".86 from neck
Character of broken surface		silky
Elongation of inch sections		".33", ".16

No. 5330.

Marks, H. L. 4.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000250	.000150	.....	.....	
3,000	15,000	.000400	.000150	.....	.....	
4,000	20,000	.000550	.000150	.....	.....	
5,000	25,000	.000750	.000200	.....	.....	
6,000	30,000	.000950	.000200	0.	.....	
7,000	35,000	.001100	.000150	.....	.....	
8,000	40,000	.001450	.000350	0.	.....	Elastic limit.
8,200	41,000	.002050	.000600	.....	.....	
8,400	42,000	.007550	.005500	.....	.....	
8,600	43,000	.008500	.000950	.....	.....	
8,800	44,000	.009050	.000550	.....	.....	
9,000	45,000	.010100	.001050	.....	.....	
10,000	50,000	.013550	.003450	.....	.....	
11,000	55,000	.017550	.004000	.....	.....	
12,000	60,000	.021950	.004400	.....	.....	
13,000	65,000	.027750	.005800	.....	.....	
14,000	70,000	.033550	.005800	.....	.....	
15,000	75,000	.042600	.009050	.....	.....	
16,000	80,000	.055900	.013300	.....	.....	
17,000	85,000	.0750	.0191	.....	.....	
16,000	90,000	.1350	.0600	.....	.....	
18,030	90,150	.1600	.0250	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,150
Elastic limit per square inch of original section	do...	40,000
Elongation per inch after rupture	inch..	.2450
Elongation per inch under strain at elastic limit	do...	.001450
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		".90 from neck
Character of broken surface		silky
Elongation of inch sections		".34", ".15

No. 5331.

Marks, H. L. 6.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100			
2,000	10,000	.000150	.000050			
3,000	15,000	.000400	.000250			
4,000	20,000	.000600	.000200			
5,000	25,000	.000700	.000100			
6,000	30,000	.000950	.000250	.000050	.000050	
7,000	35,000	.001100	.000150			
8,000	40,000	.001400	.000300	.000050	0.	Elastic limit.
8,200	41,000	.006950	.005550			
8,400	42,000	.007600	.000650			
8,600	43,000	.008250	.000650			
8,800	44,000	.009050	.000800			
9,000	45,000	.009750	.000700			
10,000	50,000	.013250	.003500			
11,000	55,000	.017400	.004150			
12,000	60,000	.021900	.004500			
13,000	65,000	.027000	.005100			
14,000	70,000	.033750	.006750			
15,000	75,000	.041500	.007750			
16,000	80,000	.054250	.012750			
17,000	85,000	.074000	.019750			
18,000	90,000	.1300	.0560			
18,010	90,050	.1550	.0250			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,050
Elastic limit per square inch of original section	do...	40,000
Elongation per inch after rupture	inch..	.2350
Elongation per inch under strain at elastic limit	do...	.001400
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		87.1
Position of rupture		".80 from neck
Character of broken surface		silky
Elongation of inch sections		".30", ".17

No. 5335.

Marks, H. L. 7.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".
Stem ran out of line before retesting.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	.....	.....	
2,000	10,000	.000350	.000250	.....	.....	
3,000	15,000	.000500	.000150	.....	.....	
4,000	20,000	.000650	.000150	.....	.....	
5,000	25,000	.000850	.000200	.....	.....	
6,000	30,000	.001050	.000200	.....	.....	
7,000	35,000	.001300	.000250	.....	.....	
7,200	36,000	.001350	.000050	.....	.....	
7,400	37,000	.001350	0.	.....	.....	
7,600	38,000	.001400	.000050	.....	.....	
7,800	39,000	.001450	.000050	.....	.....	
8,000	40,000	.001500	.000050	.....	.....	
8,200	41,000	.001950	.000450	.000450	.000450	

No. 5334.

Marks, S. L. 3.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Sucessive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	.....	.....	
2,000	10,000	.000200	.000100	.....	.....	
3,000	15,000	.000400	.000200	.....	.....	
4,000	20,000	.000600	.000200	.....	.....	
5,000	25,000	.000750	.000150	.....	.....	
5,800	29,000	.000950	.000200	.....	.....	Elastic limit.
6,000	30,000	.002950	.002000	.001950	.001950	
6,200	31,000	.005500	.002550	.....	.....	
6,400	32,000	.008900	.003400	.....	.....	
6,600	33,000	.012100	.003200	.....	.....	
6,800	34,000	.014000	.001900	.....	.....	
7,000	35,000	.014950	.000950	.....	.....	
8,000	40,000	.021550	.006600	.....	.....	
9,000	45,000	.029750	.008200	.....	.....	
10,000	50,000	.040500	.010750	.....	.....	
11,000	55,000	.056500	.016000	.....	.....	
12,000	60,000	.0850	.0285	.....	.....	
12,840	64,200	.1950	.1100	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	64,200
Elastic limit per square inch of original section	do...	29,000
Elongation per inch after rupture	inch..	.3200
Elongation per inch under strain at elastic limit	do...	.000950
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		1".2 from neck
Character of broken surface		silky
Elongation of inch sections		".29, ".35*

No. 5332.

Marks, S. L. 4.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000200	.000100	.....	.....	
3,000	15,000	.000300	.000100	.....	.....	
4,000	20,000	.000550	.000250	.....	.....	
5,000	25,000	.000650	.000100	.....	.....	
6,000	30,000	.000900	.000250	0.	.....	
6,200	31,000	.000950	.000050	.....	.....	Elastic limit.
6,400	32,000	.006000	.005050	.....	.....	
6,600	33,000	.011250	.005250	.....	.....	
6,800	34,000	.013300	.002050	.....	.....	
7,000	35,000	.014500	.001200	.....	.....	
8,000	40,000	.020550	.006050	.....	.....	
9,000	45,000	.029050	.008500	.....	.....	
10,000	50,000	.038500	.011450	.....	.....	
11,000	55,000	.053100	.014600	.....	.....	
12,000	60,000	.0800	.0269	.....	.....	
13,000	65,000	.1700	.0900	.....	.....	
13,010	65,050	.1950	.0250	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	65,050
Elastic limit per square inch of original section	do...	31,000
Elongation per inch after rupture	inch..	.3100
Elongation per inch under strain at elastic limit	do...	.000950
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		1".28 from neck
Character of broken surface		silky
Elongation of inch sections		".27, ".39

No. 5333.

Marks, S. L. 6.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000250	.000150	.....	.....	
3,000	15,000	.000450	.000200	.....	.....	
4,000	20,000	.000600	.000150	.....	.....	
5,000	25,000	.000750	.000150	.....	.....	
6,000	30,000	.001000	.000250	0.	.....	
7,000	35,000	.001150	.000150	.....	.....	
7,200	36,000	.001150 .017050	0. .015900	.....	.....	Elastic limit.
7,400	37,000	.017600	.000550	.....	.....	
7,600	38,000	.018750	.001150	.....	.....	
7,800	39,000	.020350	.001600	.....	.....	
8,000	40,000	.021600	.001250	.....	.....	
9,000	45,000	.029050	.007450	.....	.....	
10,000	50,000	.038250	.009200	.....	.....	
11,000	55,000	.053000	.014750	.....	.....	
12,000	60,000	.0800	.0270	.....	.....	
13,000	65,000	.1650	.0850	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	65,000
Elastic limit per square inch of original section	do...	36,000
Elongation per inch after rupture	inch..	.2900
Elongation per inch under strain at elastic limit	do...	.001150
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		1" from neck
Character of broken surface		silky
Elongation of inch sections		".29*, ".19

No. 5336.

Marks, S. L. 7.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".
Stem ran out of line before retesting.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	.....	.....	
2,000	10,000	.000300	.000200	.....	.....	
3,000	15,000	.000500	.000200	.....	.....	
4,000	20,000	.000600	.000100	.....	.....	
5,000	25,000	.000850	.000250	.....	.....	
5,200	26,000	.000900	.000050	.....	.....	
5,400	27,000	.000900	0.	.....	.....	
5,600	28,000	.000950	.000050	.000050	.000050	

CAST IRON

FROM

WATERTOWN ARSENAL FOUNDRY.

CUPOLA IRON.

CAST IRON FROM WATERTOWN ARSENAL CUPOLA.

CAST IRON FOR 8″ TOP CARRIAGE AND TRAVERSE CIRCLE.

No. 5290.

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
500	2,000	.000033	.000033	.....	.....	
750	3,000	.000033	0.	.....	.....	
1,000	4,000	.000067	.000034	.....	.....	
1,250	5,000	.000100	.000033	0.	.....	
1,500	6,000	.000133	.000033	.....	.....	
1,750	7,000	.000200	.000067	.....	.....	
2,000	8,000	.000333	.000133	.....	.....	
2,250	9,000	.000367	.000034	.....	.....	
2,500	10,000	.000400	.000033	.000033	.000033	
2,750	11,000	.000433	.000033	.....	.....	
3,000	12,000	.000500	.000067	.....	.....	
3,250	13,000	.000600	.000100	.....	.....	
3,500	14,000	.000700	.000100	.....	.....	
3,750	15,000	.000767	.000067	.000033	0.	
4,000	16,000	.000867	.000100	.....	.....	
4,250	17,000	.001000	.000133	.....	.....	
4,500	18,000	.001100	.000100	.....	.....	
4,750	19,000	.001167	.000067	.....	.....	
5,000	20,000	.001333	.000166	.000167	.000134	
5,250	21,000	.001467	.000134	.....	.....	
5,500	22,000	.001667	.000200	.....	.....	
5,750	23,000	.001800	.000133	.....	.....	
6,000	24,000	.002067	.000267	.....	.....	
6,250	25,000	.002300	.000233	.000733	.000566	
6,500	26,000	.002533	.000233	.....	.....	
6,750	27,000	.002900	.000367	.....	.....	
7,000	28,000	.003400	.000500	.....	.....	
7,250	29,000	.003767	.000367	.....	.....	
7,500	30,000	.004400	.000633	.002400	.001667	
7,750	31,000	.005000	.000600	.....	.....	
8,000	32,000	.005800	.000800	.....	.....	
8,250	33,000	.006467	.000667	.....	.....	
8,500	34,000	.007533	.001066	.....	.....	
8,680	34,720	.....	.....	.....	.....	Tensile strength.

Fractured 1″ from the neck. Appearance, fine granular.

Lining for Cylinder of 12″ B. L. Rifle Carriage.

No. 5293

Marks, No. 1.
Diameter, 1″.109.
Sectional area, .966 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
966	1,000	0.	0.	0.	.....	Initial load.
1,932	2,000	.00005	.00005	.....	.....	
2,898	3,000	.00010	.00005	.....	.....	
3,864	4,000	.00015	.00005	.....	.....	
4,830	5,000	.00021	.00006	0.	.....	
5,796	6,000	.00028	.00007	.....	.....	
6,762	7,000	.00032	.00004	.....	.....	
7,728	8,000	.00039	.00007	.....	.....	
8,694	9,000	.00048	.00009	.....	.....	
9,660	10,000	.00056	.00008	.00004	.00004	
10,626	11,000	.00063	.00007	.....	.....	
11,592	12,000	.00074	.00011	.....	.....	
12,558	13,000	.00085	.00011	.....	.....	
13,524	14,000	.00096	.00011	.....	.....	
14,490	15,000	.00109	.00013	.00019	.00015	
15,456	16,000	.00121	.00012	.....	.....	
16,422	17,000	.00139	.00018	.....	.....	
17,388	18,000	.00158	.00019	.....	.....	
18,354	19,000	.00181	.00023	.....	.....	
19,320	20,000	.00210	.00029	.00070	.00051	
20,286	21,000	.00241	.00031	.....	.....	
21,252	22,000	.00272	.00031	.....	.....	
22,218	23,000	.00320	.00048	.....	.....	
23,184	24,000	.00365	.00045	.....	.....	
24,150	25,000	.00430	.00065	.....	.....	
28,110	29,100	.....	.....	.....	.....	Tensile strength.

Fractured 3″.25 from neck. Appearance, fine granular, granitic.

No. 5294.

LINING FOR CYLINDER, 12″ B. L. RIFLE CARRIAGE.

Mark, 2.
Diameter, 1″.109.
Sectional area, .966 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
966	1,000	0.	0.	0.	0.	Initial load.
1,932	2,000	.00004	.00004	.....	.....	
2,898	3,000	.00010	.00006	.....	.....	
3,864	4,000	.00017	.00007	.....	.....	
4,830	5,000	.00021	.00004	0.	.....	
5,796	6,000	.00029	.00008	.....	.....	
6,762	7,000	.00037	.00008	.....	.....	
7,728	8,000	.00043	.00006	.....	.....	
8,694	9,000	.00050	.00007	.....	.....	
9,660	10,000	.00060	.00010	.00005	.00005	
10,626	11,000	.00070	.00010	.....	.....	
11,592	12,000	.00081	.00011	.....	.....	
12,558	13,000	.00092	.00011	.....	.....	
13,524	14,000	.00105	.00013	.....	.....	
14,490	15,000	.00120	.00015	.00023	.00018	
15,456	16,000	.00138	.00018	.....	.....	
16,422	17,000	.00157	.00019	.....	.....	
17,388	18,000	.00180	.00023	.....	.....	
18,354	19,000	.00205	.00025	.....	.....	
19,320	20,000	.00238	.00033	.00092	.00069	
20,286	21,000	.00278	.00040	.....	.....	
21,252	22,000	.00320	.00042	.....	.....	Tensile strength.

Fractured ″.65 from neck. Appearance, fine granular.
Specific gravity, 7.1928.

No. 5297.

BOTTOM ROLLER PATH, 8″ CARRIAGE AND 7″ SHELL.

Marks, No. 777.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.
Spongy metal on one side of the specimen covering a length of 4″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00011	.00005	.....	.....	
4,000	4,000	.00016	.00005	.....	.....	
5,000	5,000	.00022	.00006	0.	.....	
6,000	6,000	.00028	.00006	.....	.....	
7,000	7,000	.00033	.00005	.....	.....	
8,000	8,000	.00040	.00007	.....	.....	
9,000	9,000	.00048	.00008	.....	.....	
10,000	10,000	.00053	.00005	.00003	.00003	
11,000	11,000	.00061	.00008	.....	.....	
12,000	12,000	.00069	.00008	.....	.....	
13,000	13,000	.00078	.00009	.....	.....	
14,000	14,000	.00087	.00009	.....	.....	
15,000	15,000	.00096	.00009	.00012	.00009	
16,000	16,000	.00107	.00011	.....	.....	
17,000	17,000	.00118	.00011	.....	.....	
18,000	18,000	.00130	.00012	.....	.....	
19,000	19,000	.001$_{4}$6	.00016	.....	.....	
20,000	20,000	.00162	.00016	.00039	.00027	
21,000	21,000	.00181	.00019	.....	.....	
22,000	22,000	.00206	.00025	.....	.....	
22,400	22,400	.....	.....	.....	.....	Tensile strength.

Fractured 1″.7 from neck. Appearance, granular, granitic, 10 per cent spongy.
Fractured in the spongy section.

No. 5298.

DUPLICATE OF No. 5297.

Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.
Spongy metal on one side for a length of 2½″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006			
3,000	3,000	.00011	.00005			
4,000	4,000	.00017	.00006			
5,000	5,000	.00022	.00005	.00001	.00001	
6,000	6,000	.00029	.00007			
7,000	7,000	.00035	.00006			
8,000	8,000	.00041	.00006			
9,000	9,000	.00049	.00008			
10,000	10,000	.00054	.00005	.00004	.00003	
11,000	11,000	.00061	.00007			
12,000	12,000	.00070	.00009			
13,000	13,000	.00079	.00009			
14,000	14,000	.00087	.00008			
15,000	15,000	.00095	.00008	.00011	.00007	
16,000	16,000	.00106	.00011			
17,000	17,000	.00115	.00009			
18,000	18,000	.00127	.00012			
19,000	19,000	.00139	.00012			
20,000	20,000	.00152	.00013	.00033	.00022	
21,000	21,000	.00169	.00017			
22,000	22,000	.00184	.00015			
23,000	23,000	.00210	.00027			
24,000	24,000	.00234	.00024			
25,000	25,000	.00263	.00029	.00099	.00066	
26,180	26,180					Tensile strength.

Fractured 2″.9 from neck. Appearance, granular, granitic, 8 per cent spongy.
Fractured at the spongy section.

CAST-IRON FOR 8-INCH CARRIAGE.

No. 5307.

BOTTOM ROLLER PATH.

Marks, No. 780.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00010	.00004	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00020	.00006	.00001	.00001	
6,000	6,000	.00027	.00007	.....	.....	
7,000	7,000	.00032	.00005	.....	.....	
8,000	8,000	.00039	.00007	.....	.....	
9,000	9,000	.00043	.00004	.....	.....	
10,000	10,000	.00051	.00008	.00002	.00001	
11,000	11,000	.00059	.00008	.....	.....	
12,000	12,000	.00064	.00005	.....	.....	
13,000	13,000	.00070	.00006	.....	.....	
14,000	14,000	.00080	.00010	.....	.....	
15,000	15,000	.00090	.00010	.00010	.00008	
16,000	16,000	.00098	.00008	.....	.....	
17,000	17,000	.00108	.00010	.....	.....	
18,000	18,000	.00117	.00009	.....	.....	
19,000	19,000	.00128	.00011	.....	.....	
20,000	20,000	.00140	.00012	.00023	.00013	
21,000	21,000	.00152	.00012	.....	.....	
22,000	22,000	.00167	.00015	.....	.....	
23,000	23,000	.00184	.00017	.....	.....	
24,000	24,000	.00206	.00022	.....	.....	
25,000	25,000	.00224	.00018	.00070	.00047	
26,000	26,000	.00245	.00021	.....	.....	
27,000	27,000	.00272	.00027	.....	.....	
28,000	28,000	.00310	.00038	.00125	.00055	
30,010	30,010	.....	.....	.....	.....	Tensile strength.

Fractured at the neck. Appearance, granular, granitic.

CAST IRON FOR 7″ SHELL AND 8″ AND 12″ SHOT.

No. 5315.

Marks, No. 783.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00007	.00007	.....	.....	
3,000	3,000	.00011	.00004	.....	.....	
4,000	4,000	.00019	.00008	.....	.....	
5,000	5,000	.00025	.00006	0.	.....	
6,000	6,000	.00031	.00006	.....	.....	
7,000	7,000	.00039	.00008	.....	.....	
8,000	8,000	.00043	.00004	.....	.....	
9,000	9,000	.00051	.00008	.....	.....	
10,000	10,000	.00060	.00009	.00002	.00002	
11,000	11,000	.00068	.00008	.....	.....	
12,000	12,000	.00076	.00008	.....	.....	
13,000	13,000	.00085	.00009	.....	.....	
14,000	14,000	.00093	.00008	.....	.....	
15,000	15,000	.00104	.00011	.00011	.00009	
16,000	16,000	.00115	.00011	.....	.....	
17,000	17,000	.00126	.00011	.....	.....	
18,000	18,000	.00139	.00013	.....	.....	
19,000	19,000	.00151	.00012	.....	.....	
20,000	20,000	.00169	.00018	.00031	.00020	
21,000	21,000	.00185	.00016	.....	.....	
22,000	22,000	.00204	.00019	.....	.....	
23,000	23,000	.00225	.00021	.....	.....	
24,000	24,000	.00253	.00028	.....	.....	
25,000	25,000	.00284	.00031	.00098	.00067	
26,000	26,000	.00320	.00036	.....	.....	
27,000	27,000	.00360	.00040	.....	.....	
28,000	28,000	.00415	.00055	.00194	.00096	Tensile strength.

Fractured at the neck. Appearance, fine granular, granitic.

CAST IRON FOR 7″ SHELL AND 8″ AND 12″ SHOT.

No. 5318.

Marks, No. 785.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00011	.00005	.....	.....	
4,000	4,000	.00018	.00007	.....	.....	
5,000	5,000	.00024	.00006	.00001	.00001	
6,000	6,000	.00030	.00006	.....	.....	
7,000	7,000	.00038	.00008	.....	.....	
8,000	8,000	.00046	.00008	.....	.....	
9,000	9,000	.00051	.00005	.....	.....	
10,000	10,000	.00060	.00009	.00004	.00003	
11,000	11,000	.00069	.00009	.....	.....	
12,000	12,000	.00077	.00008	.....	.....	
13,000	13,000	.00086	.00009	.....	.....	
14,000	14,000	.00095	.00009	.....	.....	
15,000	15,000	.00104	.00009	.00011	.00007	
16,000	16,000	.00114	.00010	.....	.....	
17,000	17,000	.00128	.00014	.....	.....	
18,000	18,000	.00139	.00011	.....	.....	
19,000	19,000	.00151	.00012	.....	.....	
20,000	20,000	.00168	.00017	.00032	.00021	
21,000	21,000	.00188	.00020	.....	.....	
22,000	22,000	.00203	.00015	.....	.....	
23,000	23,000	.00228	.00025	.....	.....	
24,000	24,000	.00250	.00022	.....	.....	
25,000	25,000	.00280	.00030	.00098	.00066	
27,400	27,400	.....	.....	.....	.....	Tensile strength.

Fractured at the neck. Appearance, granular, granitic.

CAST IRON FOR TRAVERSE CIRCLE 8″ TOP CARRIAGE.

No. 5319.

Marks, No. 786.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00005	.00005	.....	.....	
3,000	3,000	.00010	.00005	.....	.....	
4,000	4,000	.00015	.00005	.....	.....	
5,000	5,000	.00021	.00006	0.	.....	
6,000	6,000	.00027	.00006	.....	.....	
7,000	7,000	.00031	.00004	.....	.....	
8,000	8,000	.00039	.00008	.....	.....	
9,000	9,000	.00045	.00006	.....	.....	
10,000	10,000	.00050	.00005	.00001	.00001	
11,000	11,000	.00059	.00009	.....	.....	
12,000	12,000	.00064	.00005	.....	.....	
13,000	13,000	.00071	.00007	.....	.....	
14,000	14,000	.00080	.00009	.....	.....	
15,000	15,000	.00089	.00009	.00009	.00008	
16,000	16,000	.00099	.00010	.....	.....	
17,000	17,000	.00109	.00010	.....	.....	
18,000	18,000	.00119	.00010	.....	.....	
19,000	19,000	.00131	.00012	.....	.....	
20,000	20,000	.00146	.00015	.00030	.00021	
21,000	21,000	.00160	.00014	.....	.....	
22,000	22,000	.00178	.00018	.....	.....	
23,000	23,000	.00199	.00021	.....	.....	
24,000	24,000	.00223	.00024	.....	.....	
25,000	25,000	.00257	.00034	.00101	.00071	
26,000	26,000	.00292	.00035	.....	.....	
27,000	27,000	.00332	.00040	.....	.....	
28,000	28,000	.00389	.00057	.00205	.00104	
33,400	33,400	.....	.....	.....	.....	Tensile strength.

Fractured at the neck. Appearance, fine granular.

CAST IRON FOR 7″ SHOT AND 12″ SHELL.

No. 5322.

Marks, No. 787.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00012	.00006	.....	.....	
4,000	4,000	.00018	.00006	.....	.....	
5,000	5,000	.00023	.00005	.00001	.00001	
6,000	6,000	.00031	.00008	.....	.....	
7,000	7,000	.00039	.00008	.....	.....	
8,000	8,000	.00043	.00004	.....	.....	
9,000	9,000	.00051	.00008	.....	.....	
10,000	10,000	.00059	.00008	.00002	.00001	
11,000	11,000	.00065	.00006	.....	.....	
12,000	12,000	.00073	.00008	.....	.....	
13,000	13,000	.00082	.00009	.....	.....	
14,000	14,000	.00091	.00009	.....	.....	
15,000	15,000	.00101	.00010	.00010	.00008	
16,000	16,000	.00111	.00010	.....	.....	
17,000	17,000	.00122	.00011	.....	.....	
18,000	18,000	.00133	.00011	.....	.....	
19,000	19,000	.00149	.00016	.....	.....	
20,000	20,000	.00162	.00013	.00026	.00016	
21,000	21,000	.00181	.00019	.....	.....	
22,000	22,000	.00199	.00018	.....	.....	
23,000	23,000	.00220	.00021	.....	.....	
24,000	24,000	.00247	.00027	.....	.....	
25,000	25,000	.00272	.00025	.00082	.00056	
26,000	26,000	.00310	.00038	.00109	.00027	
27,610	27,610	.....	.....	.....	.....	Tensile strength.

CAST IRON

FROM

WATERTOWN ARSENAL FOUNDRY,

AND

PIG IRONS.

CAST IRON FROM WATERTOWN ARSENAL FOUNDRY, AND PIG IRONS.

The specimens of cast iron were taken from cylinders 18 inches long by 8 inches diameter, cored 3½ inches in diameter, poured from the same metal as the castings they represented.

Specimens of pig iron were turned down directly from sample pigs.

The furnace charges were as follows.

The heads referred to in the furnace charges were heads of shell from previous casts.

The scrap iron used was old shot and shell, bolsters, and gun-carriage scrap of good quality.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
July 24, 1894	Richmond pig	3,000	Cupola	5123
	Salisbury pig	1,500		
	Scrap	13,500		
	Total	18,000		
August 11, 1894	Richmond pig	3,000	....do	5128
	Salisbury pig	1,500		
	Scrap	8,500		
	Total	13,000		
August 22, 1894	Richmond pig	3,000	....do	5133
	Salisbury pig	1,500		
	Scrap	2,500		
	Heads	3,000		
	Total	10,000		
August 30, 1894	Katahdin pig No. 4	2,000	....do	5132
	Katahdin pig No. 4, high	4,000		
	Heads	3,000		
	Scrap	2,500		
	Total	11,500		
September 6, 1894	Katahdin pig	2,000	....do	5135
	Richmond pig	2,500		
	Heads	3,000		
	Scrap	3,500		
	Total	11,000		
September 19, 1894	Katahdin pig	1,500	....do	5137
	Richmond pig	1,500		
	Heads	2,000		
	Scrap	4,500		
	Total	10,500		
September 26, 1894	Richmond pig	3,000	....do	5141
	Salisbury pig	1,500		
	Heads	1,000		
	Scrap	4,000		
	Total	9,500		
October 8, 1894	Salisbury pig No. 4, high	3,600	....do	5145
	Salisbury pig No. 4	1,900		
	Scrap	4,500		
	Total	10,000		
October 11, 1894	Salisbury pig No. 4, high	3,600	....do	5146
	Salisbury pig No. 4	1,900		
	Scrap	3,500		
	Total	9,000		

Cast iron from Watertown Arsenal Foundry, and pig irons—Continued.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
October 15, 1894	Salisbury pig No. 4, high	3,000	Cupola	5147
	Salisbury pig No. 4	2,000		
	Heads	1,000		
	Scrap	4,000		
	Total	10,000		
October 18, 1894	Salisbury pig No. 4, high	3,000	....do	5149
	Salisbury pig No. 4	2,500		
	Heads	2,000		
	Scrap	3,500		
	Total	11,000		
October 22, 1894	Salisbury pig No. 4, high	3,000	....do	5148
	Salisbury pig No. 4	2,500		
	Heads	2,500		
	Scrap	3,500		
	10-inch shell	1,500		
	Total	13,000		
October 25, 1894	Salisbury pig No. 4, high	3,000	....do	5150
	Salisbury pig No. 4	2,500		
	10-inch shell	1,500		
	Heads	2,500		
	Scrap	3,500		
	Total	13,000		
October 29, 1894	Salisbury pig No. 4, high	3,000	....do	5152
	Salisbury pig No. 4	2,500		
	Heads	2,500		
	10-inch shell	1,500		
	Scrap	3,500		
	Total	13,000		
November 1, 1894	Salisbury pig No. 4, high	3,000	....do	5153
	Salisbury pig No. 4	2,500		
	Heads	2,500		
	10-inch shell	2,500		
	Scrap	3,500		
	Total	14,000		
November 6, 1894	Salisbury pig No. 4, high	3,000	... do	5155
	Salisbury pig No. 4	2,500		
	Heads	2,500		
	10-inch shell	1,500		
	Scrap	3,500		
	Total	13,000		
November 9, 1894	Salisbury pig No. 4, high	3,000	....do	5156
	Salisbury pig No. 4	2,500		
	Heads	2,500		
	10-inch shell	1,500		
	Scrap	3,500		
	Total	13,000		
November 13, 1894	Salisbury pig No. 4, high	3,000	....do	5157
	Salisbury pig No. 4	2,500		
	Heads	2,500		
	10-inch shell	2,000		
	Scrap	2,000		
	Total	12,000		
November 16, 1894	Salisbury pig No. 4, high	2,500	....do	5158
	Salisbury pig No. 4	2,500		
	Heads	3,000		
	10-inch shell	2,500		
	Total	10,500		
November 20, 1894	Salisbury pig No. 4, high	2,500	....do	5159
	Salisbury pig No. 4	2,500		
	Heads	3,000		
	10-inch shell	2,500		
	Total	10,500		

Cast iron from Watertown Arsenal Foundry, and pig irons—Continued.

Date of cast.	Furnace charge.	Pounds.	Furnace.	No. of tension test.
November 23, 1894	Salisbury pig No. 4, high	2,500	Cupola	5160
	Salisbury pig No. 4	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Total	11,000		
November 27, 1894	Salisbury pig No. 4, high	2,500	....do	5161
	Salisbury pig No. 4	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Total	11,000		
December 4, 1894	Salisbury pig No. 4, high	2,500	....do	5163
	Salisbury pig No. 4	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Total	11,000		
December 7, 1894	Salisbury pig No. 4, high	2,500	....do	5167
	Salisbury pig No. 4	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Total	11,000		
December 14, 1894	Salisbury pig No. 4, high	2,500	....do	5168
	Salisbury pig No. 4	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Scrap	1,000		
	Total	12,000		
December 19, 1894	Salisbury pig No. 4, high	3,500	....do	5169
	Salisbury pig No. 4	2,500		
	Heads	3,000		
	10-inch shell	2,000		
	Scrap	1,500		
	Total	12,500		
December 26, 1894	Salisbury pig No. 4, high	2,500	....do	5174
	Salisbury pig No. 4	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Total	11,000		
January 9, 1895	Salisbury pig No. 4, high	2,000	....do	5176
	Salisbury pig No. 4	1,500		
	Heads	2,500		
	10-inch shell	2,000		
	Scrap	6,000		
	Total	14,000		
January 15, 1895	Salisbury pig No. 4, high	2,000	....do	5179
	Salisbury pig No. 4	1,500		
	Heads	2,500		
	10-inch shell	2,000		
	Scrap	5,000		
	Total	13,000		
January 26, 1895	Salisbury pig No. 4, high	4,000	....do	5182
	Salisbury pig No. 4	3,500		
	Heads	2,500		
	10-inch shell	2,000		
	Scrap	1,500		
	Total	13,500		
February 6, 1895	Salisbury pig No. 4, high	2,750	....do	5185
	Salisbury pig No. 4	2,750		
	Heads	2,500		
	10-inch shell	2,000		
	Scrap	4,000		
	Total	14,000		

Cast iron from Watertown Arsenal Foundry, and pig irons—Continued.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
February 23, 1895	Salisbury pig No. 4, high	1,000	Cupola	5194
	Salisbury pig No. 4	1,000		
	Heads	1,500		
	10-inch shell	1,000		
	Scrap	6,000		
	Total	10,500		
March 6, 1895	Salisbury pig No. 4, high	2,250	do	5198
	Salisbury pig No. 4	2,250		
	Muirkirk pig No. 4, high	2,250		
	Muirkirk pig No. 4	2,250		
	Watervliet Arsenal pig	7,000		
	Total	16,000		
March 13, 1895	Salisbury pig No. 4, high	1,750	do	5200
	Salisbury pig No. 4	1,750		
	Heads	2,500		
	10-inch shell	2,000		
	Scrap	5,000		
	Total	13,000		
March 20, 1895	Salisbury pig No. 4, high	1,350	do	5201
	Salisbury pig No. 4	1,350		
	Muirkirk pig No. 4, high	1,350		
	Muirkirk pig No. 4	1,350		
	Heads	2,500		
	10-inch shell	1,500		
	Scrap	5,600		
	Total	15,900		
March 27, 1895	Salisbury pig No. 4, high	1,000	do	5202
	Salisbury pig No. 4	1,000		
	Heads	1,000		
	10-inch shell	500		
	Soft pig	1,500		
	Scrap	5,000		
	Total	10,000		
April 11, 1895	Salisbury pig No. 4, high	1,000	do	5205
	Salisbury pig No. 4	1,000		
	Heads	1,000		
	10-inch shell	500		
	Scrap	6,500		
	Total	10,000		
April 18, 1895	Salisbury pig No. 4, high	3,000	do	5206
	Salisbury pig No. 4	3,000		
	Heads	2,500		
	10-inch shell	1,500		
	Scrap	3,000		
	Total	13,000		
April 26, 1895	Salisbury pig No. 4, high	1,000	do	5208
	Salisbury pig No. 4	1,000		
	Heads	1,000		
	10-inch shell	500		
	Scrap	6,500		
	Total	10,000		
May 7, 1895	Salisbury pig No. 4, high	2,000	do	5209
	Salisbury pig No. 4	2,000		
	Heads	3,500		
	10-inch shell	3,000		
	Total	10,500		
May 14, 1895	Salisbury pig No. 4, high	2,000	do	5211
	Salisbury pig No. 4	2,000		
	Heads	3,000		
	10-inch shell	2,000		
	Scrap	5,000		
	Total	14,000		

Cast iron from Watertown Arsenal Foundry, and pig irons—Continued.

Date of cast.	Furnace charge.	Pounds.	Furnace.	No. of tension test.
May 22, 1895	Salisbury pig No. 4, high	1,200	Cupola	5217
	Muirkirk pig No. 4, high	1,000		
	Katahdin pig No. 4, high	2,000		
	Watervliet Arsenal pig	2,000		
	Heads	3,500		
	10-inch shell	2,500		
	Scrap	1,800		
	Total	14,000		
June 3, 1895	Salisbury pig No. 4, high	1,500	....do	5219
	Salisbury pig No. 4	1,500		
	Watervliet Arsenal pig	2,000		
	Heads	3,000		
	10-inch shell	2,000		
	Scrap	2,000		
	Total	12,000		
June 8, 1895	Salisbury pig No. 4, high	3,000	....do	5220
	Salisbury pig No. 4	3,000		
	Watervliet Arsenal pig	4,000		
	Heads	3,500		
	10-inch shell	3,000		
	Total	16,500		
June 12, 1895	Salisbury pig No. 4, high	3,000	....do	5222
	Salisbury pig No. 4	3,000		
	Watervliet Arsenal pig	4,000		
	Heads	3,500		
	10-inch shell	3,500		
	Scrap	1,000		
	Total	18,000		
June 19, 1895	Salisbury pig No. 4, high	1,500	....do	5223
	Salisbury pig No. 4	1,500		
	Watervliet Arsenal pig	2,000		
	Heads	1,500		
	Scrap from 8-inch top carriage	1,500		
	10-inch shell	2,000		
	Scrap	10,000		
	Total	20,000		
June 26, 1895	Muirkirk pig No. 4, high	2,000	....do	5224
	Muirkirk pig No. 4	2,000		
	Katahdin pig	1,000		
	Watervliet Arsenal pig	3,000		
	Scrap from 8-inch top carriage	1,500		
	Heads	2,000		
	10-inch shell	2,000		
	Scrap	2,000		
	Total	15,500		
July 6, 1894	Charcoal pig	10,000	Air furnace	5122
	Soft pig	10,000		
	Remelted pig	10,000		
	Total	30,000		
July 26, 1894	Charcoal pig	12,000	....do	5124
	Soft pig	6,000		
	Remelted pig	7,000		
	Total	25,000		
October 5, 1894	Salisbury pig No. 4, high	2,000	....do	5144
	Richmond pig No. 4, high	2,500		
	Richmond pig No. 4	2,000		
	Katahdin pig No. 4, high	5,500		
	Soft pig	6,000		
	Remelted pig	7,000		
	Total	25,000		

Cast iron from Watertown Arsenal Foundry, and pig irons—Continued.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
January 3, 1895	Salisbury pig No. 4, high	4,000	Air furnace	5175
	Salisbury pig No. 4	4,000		
	Katahdin pig	5,000		
	Soft pig	5,000		
	Remelted pig	7,000		
	Total	25,000		
May 29, 1895	Muirkirk pig No. 4, high	6,000	....do	5218
	Muirkirk pig No. 4	4,000		
	Salisbury pig No. 4, high	3,000		
	Salisbury pig No. 4	2,000		
	Soft pig	2,000		
	Remelted pig	1,000		
	Total	18,000		
August 17, 1894	Charcoal pig	12,000	....do	5131
	Soft pig	6,000		
	Remelted pig	8,000		
	Total	26,000		
September 10, 1894	Charcoal pig	12,000	....do	5136
	Soft pig	6,000		
	Remelted pig	7,000		
	Total	25,000		
November 3, 1894	Salisbury pig No. 4, high	3,000	....do	5154
	Salisbury pig No. 4	3,000		
	Katahdin pig	6,000		
	Soft pig	6,000		
	Remelted pig	7,000		
	Total	25,000		
December 1, 1894	Salisbury pig	6,000	....do	5162
	Katahdin pig	6,000		
	Soft pig	6,000		
	Remelted pig	7,000		
	Total	25,000		
January 30, 1895	Salisbury pig No. 4, high	4,500	Cupola	5184
	Salisbury pig No. 4	4,500		
	Heads	2,500		
	10-inch shell	2,000		
	Scrap	1,500		
	Total	15,000		
February 15, 1895	Salisbury pig No. 4, high	3,000	....do	5188
	Salisbury pig No. 4	3,000		
	Heads	2,000		
	10-inch shell	2,000		
	Scrap	5,000		
	Total	15,000		
March 6, 1895	Salisbury pig No. 4, high	2,250	....do	5198
	Salisbury pig No. 4	2,250		
	Muirkirk pig No. 4, high	2,250		
	Muirkirk pig No. 4	2,250		
	Watervliet Arsenal pig	7,000		
	Total	16,000		
March 20, 1895	Salisbury pig No. 4, high	1,350	....do	5201
	Salisbury pig No. 4	1,350		
	Muirkirk pig No. 4, high	1,350		
	Muirkirk pig No. 4	1,350		
	Heads	2,500		
	10-inch shell	1,500		
	Scrap	5,600		
	Total	15,000		

Cast iron from Watertown Arsenal Foundry, and pig irons—Continued.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
March 30, 1895	Salisbury pig No. 4, high	3,500	Cupola	5203
	Salisbury pig No. 4	3,500		
	Heads	1,500		
	10-inch shell	1,500		
	Scrap	5,000		
	Total	15,000		
January 23, 1895	Salisbury pig No. 4, high	7,500	Air furnace	5183
	Salisbury pig No. 4	4,000		
	Salisbury pig No. 1	500		
	Total	12,000		
February 8, 1895	Salisbury pig No. 4, high	4,500	do	5186
	Salisbury pig No. 4	4,500		
	Scrap	3,500		
	Total	12,500		
February 27, 1895	Salisbury pig No. 4, high	3,200	do	5196
	Salisbury pig No. 4	3,200		
	Salisbury pig No. 1	1,600		
	Muirkirk pig No. 4, high	2,000		
	Muirkirk pig No. 4	2,000		
	Total	12,000		
April 4, 1895	Muirkirk pig No. 4, high	3,000	do	5204
	Muirkirk pig No. 4	3,000		
	Salisbury pig No. 4, high	2,300		
	Salisbury pig No. 4	2,200		
	Soft pig	1,500		
	Total	12,000		
April 22, 1895	Muirkirk pig No. 4, high	3,000	do	5207
	Muirkirk pig No. 4	3,000		
	Salisbury pig No. 4, high	2,300		
	Salisbury pig No. 4	2,200		
	Soft	1,500		
	Total	12,000		
May 10, 1895	Muirkirk pig No. 4, high	3,000	do	5210
	Muirkirk pig No. 4	3,000		
	Salisbury pig No. 4, high	2,300		
	Salisbury pig No. 4	2,200		
	Soft pig	1,500		
	Total	12,000		
January 19, 1895	Salisbury pig No. 4, high	2,000	Cupola	5180
	Salisbury pig No. 4	2,000		
	Scrap	9,000		
	Total	13,000		
January 26, 1895	Salisbury pig No. 4, high	4,000	do	5182
	Salisbury pig No. 4	3,500		
	Heads	2,500		
	10-inch shell	2,000		
	Scrap	1,500		
	Total	13,500		
May 14, 1895	Salisbury pig No. 4, high	2,000	do	5211
	Salisbury pig No. 4	2,000		
	Heads	3,000		
	10-inch shell	2,000		
	Scrap	5,000		
	Total	14,000		
February 8, 1895	Salisbury pig No. 4, high	4,500	do	5189
	Salisbury pig No. 4	4,500		
	Scrap	3,500		
	Total	12,500		

Cast iron from Watertown Arsenal Foundry, and pig irons—Continued.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
February 19, 1895	Scrap	7,000	Cupola	5192
March 12, 1895	Salisbury pig No. 4, high	1,500	....do	5197
	Salisbury pig No. 4	1,500		
	Muirkirk pig No. 4, high	1,500		
	Muirkirk pig No. 4	1,500		
	Heads	3,000		
	10-inch shell	3,000		
	Scrap	3,000		
	Total	15,000		
March 6, 1895	Salisbury pig No. 4, high	2,250	...do	5199
	Salisbury pig No. 4	2,250		
	Muirkirk pig No. 4, high	2,250		
	Muirkirk pig No. 4	2,250		
	Watervliet Arsenal pig	7,000		
	Total	16,000		

CAST IRON FROM WATERTOWN ARSENAL FOUNDRY, AND PIG IRONS.

The specimens of cast iron were taken from cylinders 18 inches long by 8 inches diameter, cored 3½ inches in diameter, poured from the same metal as the castings they represented.

Specimens of pig iron were turned down directly from sample pigs.

The furnace charges were as follows.

The heads referred to in the furnace charges were heads of shell from previous casts.

The scrap iron used was old shot and shell, bolsters, and gun-carriage scrap of good quality.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
July 24, 1894	Richmond pig	3,000	Cupola	5123
	Salisbury pig	1,500		
	Scrap	13,500		
	Total	18,000		
August 11, 1894	Richmond pig	3,000	do	5128
	Salisbury pig	1,500		
	Scrap	8,500		
	Total	13,000		
August 23, 1894	Richmond pig	3,000	do	5133
	Salisbury pig	1,500		
	Scrap	2,500		
	Heads	3,000		
	Total	10,000		
August 30, 1894	Katahdin pig No. 4	2,000	do	5132
	Katahdin pig No. 4, high	4,000		
	Heads	3,000		
	Scrap	2,500		
	Total	11,500		
September 6, 1894	Katahdin pig	2,000	do	5135
	Richmond pig	2,500		
	Heads	3,000		
	Scrap	3,500		
	Total	11,000		
September 19, 1894	Katahdin pig	1,500	do	5137
	Richmond pig	1,500		
	Heads	2,000		
	Scrap	4,500		
	Total	10,500		
September 26, 1894	Richmond pig	3,000	do	5141
	Salisbury pig	1,500		
	Heads	1,000		
	Scrap	4,000		
	Total	9,500		
October 8, 1894	Salisbury pig No. 4, high	3,600	do	5145
	Salisbury pig No. 4	1,900		
	Scrap	4,500		
	Total	10,000		
October 11, 1894	Salisbury pig No. 4, high	3,600	do	5146
	Salisbury pig No. 4	1,900		
	Scrap	3,500		
	Total	9,000		

CAST IRON FROM WATERTOWN ARSENAL FOUNDRY—Continued.

No. of test.	Description.	Date of cast.	Chemical composition.								Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.
			Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.				
			Total.	Graphitic.	Combined.									
		1894.									*Pounds.*			
5163	3″.2 shell and 12″ shot	Dec. 4									28,620	Fine granular, granitic	7.2393	17.90
5167	7″ shell and 12″ shot	Dec. 7									28,150	....do	7.2320	17.99
5168	....do	Dec. 14									30,020	....do	7.2557	18.19
5169	....do	Dec. 19									31,100	....do	7.2614	14.06
5174	....do	Dec. 26									28,990	....do	7.2187	16.64
		1895.												
5176	12″ shot	Jan. 9									29,170	....do	7.1664	12.90
5179	12″ shell	Jan. 15									29,120	Granular	7.1639	12.60
5182	12″ shot	Jan. 26									33,040	Fine granular	7.2035	13.72
5185	12″ shot and 15″ shell	Feb. 6									30,700	Fine granular, granitic	7.2271	17.35
5194	15″ shell	Feb. 23									32,950	....do	7.2072	16.30
5195	8″ Eureka shell										30,860	Fine granular	7.2220	15.20
5198	15″ shell	Mar. 6									32,200	Fine granular, granitic	7.2175	15.75
5200	12″ shot and 15″ shell	Mar. 13									31,980	....do	7.2254	16.90
5201	7″ shell	Mar. 20									32,170	....do	7.2319	15.99
5202	7″ shell, 8″ and 12″ shot	Mar. 27									30,650	....do	7.2287	17.81
5205	....do	Apr. 11									29,600	....do	7.2244	18.09
5206	....do	Apr. 18									29,700	....do	7.1773	16.81
5208	....do	Apr. 26									29,200	....do	7.1946	17.71
5209	....do										33,020	Granular	7.2390	14.33
5211	7″ shell and 12″ shot	May 14									32,490	....do	7.2476	15.13
5217	7″ and 12″ shell and 12″ shot	May 22									29,150	Fine granular, light gray	7.2096	13.26
5219	7″ shell and 12″ shot	June 3									28,580	Granular, coarse granitic marking	7.3293	20.14
5220	7″ shell, 12″ shot and shell	June 8									26,800	....do	7.2944	18.48
5222	....do	June 13									30,010	Fine granular, granitic	7.2756	18.48
5223	....do	June 19									30,210	.... do	7.2242	15.51
5224	....do	June 26									29,240	....do	7.2207	.....
		1894.												
5122	Bottom roller path for 12″ carriage.	July 6	2.945	2.237	0.568	0.434	2.528	0.105	0.616	0.005	26,990	Fine granular	7.0977	10.15
5124	....do	July 26	2.945	2.558	0.387	0.461	1.898	0.115	0.557	0.000	27,300	....do	7.1066	10.88
5144	....do	Oct. 5	.....	.....	.....	.....	.....	.....	.....	.....	27,010	....do	7.1448	13.33
		1895.												
5175	....do	Jan. 3	.....	.....	.....	.....	.....	.....	.....	.....	26,940	Fine granular, granitic	7.2341	15.01
5218	....do	May 29	.....	.....	.....	.....	.....	.....	.....	.....	37,600	Fine granular, light gray	7.3201	15.99
		1894.												
5131	Bottom roller path for 10″ carriage.	Aug. 17	2.887	2.541	0.346	0.442	2.209	0.100	0.303	0.000	29,550	Fine granular	7.1519	14.12
5136	....do	Sept. 10	2.836	2.345	0.491	0.403	2.068	0.118	0.754	0.000	31,400	....do	7.1583	14.06
5154	....do	Nov. 3	3.337	2.249	1.088	0.432	0.846	0.098	0.490	0.000	30,410	....do	7.2139	17.44

Cast iron from Watertown Arsenal Foundry, and pig irons—Continued.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
November 23, 1894	Salisbury pig No. 4, high	2,500	Cupola	5160
	Salisbury pig No. 4	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Total	11,000		
November 27, 1894	Salisbury pig No. 4, high	2,500	....do	5161
	Salisbury pig No. 4	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Total	11,000		
December 4, 1894	Salisbury pig No. 4, high	2,500	....do	5163
	Salisbury pig No. 4	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Total	11,000		
December 7, 1894	Salisbury pig No. 4, high	2,500	....do	5167
	Salisbury pig No. 4	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Total	11,000		
December 14, 1894	Salisbury pig No. 4, high	2,500	....do	5168
	Salisbury pig No. 4	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Scrap	1,000		
	Total	12,000		
December 19, 1894	Salisbury pig No. 4, high	3,500	....do	5169
	Salisbury pig No. 4	2,500		
	Heads	3,000		
	10-inch shell	2,000		
	Scrap	1,500		
	Total	12,500		
December 26, 1894	Salisbury pig No. 4, high	2,500	....do	5174
	Salisbury pig No. 4	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Total	11,000		
January 9, 1895	Salisbury pig No. 4, high	2,000	....do	5176
	Salisbury pig No. 4	1,500		
	Heads	2,500		
	10-inch shell	2,000		
	Scrap	6,000		
	Total	14,000		
January 15, 1895	Salisbury pig No. 4, high	2,000	....do	5179
	Salisbury pig No. 4	1,500		
	Heads	2,500		
	10-inch shell	2,000		
	Scrap	5,000		
	Total	13,000		
January 26, 1895	Salisbury pig No. 4, high	4,000	....do	5182
	Salisbury pig No. 4	3,500		
	Heads	2,500		
	10-inch shell	2,000		
	Scrap	1,500		
	Total	13,500		
February 6, 1895	Salisbury pig No. 4, high	2,750	....do	5185
	Salisbury pig No. 4	2,750		
	Heads	2,500		
	10-inch shell	2,000		
	Scrap	4,000		
	Total	14,000		

PIG IRONS—Continued.

No. of test.	Description.	Date of cast.	Chemical composition.								Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.
			Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.				
			Total.	Graphitic.	Combined.									
											Pounds.			
5140	No. 1 Hubbard Scotch pig										8,110	Coarse and fine granulation interspersed.		
5177	Watervliet Arsenal pig		3.111	1.761	1.350	0.240	0.911	0.200	0.440		26,140	Granular, mottled		
5178	....do		3.381	2.781	0.600	0.441	1.250	0.157	0.530		21,980	Granular		
5190	Muirkirk pig No. 4										31,510	Medium fine granular	7.2673	19.08
5216	....do										29,100	Fine granular	7.2572	15.13
5191	Muirkirk pig No. 4, high										31,740	....do	7.2857	18.19
5221	....do										35,540	Fine granular, dark gray	7.2768	19.18
	Richmond pig No. 3					0.464	0.981	0.020	0.382					
	Richmond pig No. 4					0.360	0.592	0.020	0.381					

"SEMI-STEEL" FROM THE FARREL FOUNDRY AND MACHINE COMPANY, ANSONIA, CONN.

Nos. 5170 and 5171 turned down from 1″ square cast bars, Nos. 5172 and 5173 from ½″ round cast bars.

Nos. 5170 and 5171 had stems 2″ long. Nos. 5172 and 5173 were grooved form.

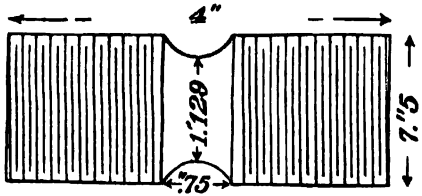
No. of test.	Diameter.	Sectional area.	Tensile strength.		Appearance of fracture.
			Total.	Per square inch.	
	Inches.	*Sq. inches.*	*Pounds.*	*Pounds.*	
5170	.564	.25	12,300	49,200	Fine granular.
5171	.564	.25	11,460	45,840	Do.
5172	1.129	1.00	46,400	46,400	Do.
5173	1.129	1.00	42,820	42,820	Do.

CHAIN CABLE, SHACKLES, AND SWIVELS.

Cast iron from Watertown Arsenal Foundry, and pig irons—Continued.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
February 19, 1895	Scrap	7,000	Cupola	5192
March 12, 1895	Salisbury pig No. 4, high	1,500	....do	5197
	Salisbury pig No. 4	1,500		
	Muirkirk pig No. 4, high	1,500		
	Muirkirk pig No. 4	1,500		
	Heads	3,000		
	10-inch shell	3,000		
	Scrap	3,000		
	Total	15,000		
March 6, 1895	Salisbury pig No. 4, high	2,250	...do	5199
	Salisbury pig No. 4	2,250		
	Muirkirk pig No. 4, high	2,250		
	Muirkirk pig No. 4	2,250		
	Watervliet Arsenal pig	7,000		
	Total	16,000		

CHEMICAL ANALYSES AND TENSION TESTS.



CAST IRON FROM WATERTOWN ARSENAL FOUNDRY.

No. of test.	Description.	Date of cast.	Chemical composition.								Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.
			Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.				
			Total.	Graphitic.	Combined.									
		1894.									*Pounds.*			
5123	8" and 10" shot	July 24	3.487	2.917	0.570	0.464	1.457	0.122	0.539	0.000	28,980	Fine granular, granitic	7.1932	17.26
5128	do	Aug. 11									26,650	Fine granular	7.1046	11.28
5133	do	Aug. 23	2.896	2.367	0.529	0.458	1.022	0.120	0.379	0.000	28,620	do	7.1861	16.47
5132	8" and 10" shell	Aug. 30									20,800	Medium granular, mottled	7.2174	15.75
5134	Base of 10" shell	do	2.727	2.017	0.710	0.438	1.193	0.125	0.350	0.000	27,240	Fine granular, granitic	7.2282	16.73
5135	8" and 10" shot	Sept. 6	3.085	2.691	0.394	0.439	1.494	0.104	0.538	0.000	24,970	Fine granular	7.1603	13.85
5137	10" shot	Sept. 19	3.580	2.786	0.794	0.446	1.372	0.100	0.521	0.000	24,880	do		
5141	do	Sept. 26	3.354	2.765	0.589	0.437	1.457	0.093	0.537	0.000	29,720	do	7.1720	13.85
5145	do	Oct. 8	3.272	2.140	1.132	0.445	0.705	0.104	0.504	0.000	32,020	Fine granular, granitic	7.2523	16.90
5146	do	Oct. 11	3.378	2.372	1.006	0.436	0.921	0.105	0.473	0.000	33,500	do	7.2363	17.17
5147	do	Oct. 15	3.308	2.356	0.952	0.432	1.071	0.100	0.531	0.000	33,400	do	7.2552	17.53
5149	10" and 12" shot	Oct. 18	3.272	2.263	1.009	0.451	0.846	0.108	0.505	0.000	32,010	do	7.2565	18.09
5148	7" shell and 12" shot	Oct. 22	3.114	2.247	0.867	0.441	0.977	0.110	0.472	0.000	32,990	do	7.2542	18.09
5150	do	Oct. 25	3.228	2.160	1.068	0.435	0.864	0.095	0.493	0.000	32,280	do	7.2514	17.99
5152	do	Oct. 29	3.190	2.208	0.982	0.430	0.874	0.096	0.498	0.000	32,200	Fine granular	7.2636	17.08
5153	do	Nov. 1	3.446	2.266	1.180	0.426	0.893	0.102	0.504	0.000	30,400	do	7.2424	16.99
5155	do	Nov. 6	3.299	2.225	1.074	0.451	0.902	0.095	0.473	0.000	32,510	Fine granular, granitic	7.2879	19.81
5156	do	Nov. 9									31,120	do	7.2412	17.35
5157	3".2 shell and 12" shot	Nov. 13									31,500	do	7.1231	
5158	do	Nov. 16									30,990	Fine granular	7.2415	16.73
5159	do	Nov. 20									30,800	Fine granular, granitic	7.2408	16.81
5160	do	Nov. 23									31,360	do	7.2355	17.08
5161	do	Nov. 27									31,540	do	7.2342	16.56

CAST IRON FROM WATERTOWN ARSENAL FOUNDRY—Continued.

No. of test.	Description.	Date of cast.	Chemical composition.								Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.
			Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.				
			Total.	Graphitic.	Combined.									
		1894.									*Pounds.*			
5163	3″.2 shell and 12″ shot	Dec. 4									28,620	Fine granular, granitic	7.2393	17.90
5167	7″ shell and 12″ shot	Dec. 7									28,150	....do	7.2320	17.99
5168	....do	Dec. 14									30,020	....do	7.2557	18.19
5169	....do	Dec. 19									31,100	....do	7.2614	14.06
5174	....do	Dec. 26									28,990	....do	7.2187	16.64
		1895.												
5176	12″ shot	Jan. 9									29,170	....do	7.1664	12.90
5179	12″ shell	Jan. 15									29,120	Granular	7.1639	12.60
5182	12″ shot	Jan. 26									33,040	Fine granular	7.2035	13.72
5185	12″ shot and 15″ shell	Feb. 6									30,700	Fine granular, granitic	7.2271	17.35
5194	15″ shell	Feb. 23									32,950	....do	7.2072	16.39
5195	8″ Eureka shell										30,860	Fine granular	7.2220	15.20
5198	15″ shell	Mar. 6									32,200	Fine granular, granitic	7.2175	15.75
5200	12″ shot and 15″ shell	Mar. 13									31,980	....do	7.2254	16.90
5201	7″ shell	Mar. 20									32,170	....do	7.2319	15.99
5202	7″ shell, 8″ and 12″ shot	Mar. 27									30,650	....do	7.2287	17.81
5205	....do	Apr. 11									29,600	....do	7.2244	18.09
5206	....do	Apr. 18									29,700	....do	7.1773	16.81
5208	....do	Apr. 26									29,200	....do	7.1946	17.71
5209	....do										33,020	Granular	7.2390	14.33
5211	7″ shell and 12″ shot	May 14									32,490	....do	7.2476	15.13
5217	7″ and 12″ shell and 12″ shot	May 22									29,150	Fine granular, light gray	7.2096	13.26
5219	7″ shell and 12″ shot	June 3									28,580	Granular, coarse granitic marking	7.3293	20.14
5220	7″ shell, 12″ shot and shell	June 8									26,800	....do	7.2944	18.48
5222	....do	June 13									30,010	Fine granular, granitic	7.2756	18.48
5223	....do	June 19									30,210	.... do	7.2242	15.51
5224	....do	June 26									29,240	.... do	7.2207	.....
		1894.												
5122	Bottom roller path for 12″ carriage.	July 6	2.945	2.237	0.568	0.434	2.528	0.105	0.616	0.005	26,990	Fine granular	7.0977	10.15
5124	....do	July 26	2.945	2.558	0.387	0.461	1.898	0.115	0.557	0.000	27,300	....do	7.1066	10.88
5144	....do	Oct. 5									27,010	....do	7.1448	13.33
		1895.												
5175	....do	Jan. 3									26,940	Fine granular, granitic	7.2341	15.91
5218	....do	May 29									37,600	Fine granular, light gray	7.3201	15.99
		1894.												
5131	Bottom roller path for 10″ carriage.	Aug. 17	2.887	2.541	0.346	0.442	2.209	0.100	0.363	0.000	29,550	Fine granular	7.1519	14.12
5136	....do	Sept. 10	2.836	2.345	0.491	0.403	2.068	0.118	0.754	0.000	31,400	....do	7.1583	14.06

5162	.....do	Dec. 1 1895.									27,700	Fine granular, granitic	7.2109	16.81
5184	Bottom roller path for 8" carriage.	Jan. 30									32,430	Fine granular	7.1996	14.76
5188	.....do	Feb. 15									29,110	Fine granular, mottled	7.1654	12.84
5198	.....do	Mar. 6									32,200	Fine granular, granitic	7.2175	15.75
5201	.....do	Mar. 20									32,170	.....do	7.2319	15.99
5203	.....do	Mar. 30									33,890	.....do	7.2569	17.44
5183	Top carriage for 8" disappearing carriage.	Jan. 23									30,390	Fine granular	7.2858	16.15
5181	.....do	.....do									31,300	.....do	7.3009	18.48
5186	.....do	Feb. 8									26,800	.....do	7.2034	14.69
5187	.....do	.....do									27,950	.....do		
5196	.....do	Feb. 27	3.053	2.386	0.667	0.441	0.800	0.090	0.538		39,540	.....do	7.3064	16.90
5204	.....do	Apr. 4									36,160	Fine granular, gray	7.2771	15.75
5207	.....do	Apr. 23									34,800	Fine granular	7.2624	14.98
5210	.....do	May 10									32,400	Granular	7.2696	15.13
5180	8" traverse circle	Jan. 19									33,160	Fine granular	7.1966	13.85
5207	.....do	Apr. 23									34,800	.....do	7.2624	14.98
5210	.....do	May 10									32,400	Granular	7.2696	15.13
5211	.....do	May 14									32,490	.....do	7.2476	15.13
5182	.....do	Jan. 26									33,040	Fine granular	7.2035	13.72
5189	Cylinder for 8" top carriage	Feb. 8									28,580	.....do	7.1878	12.90
5193	.....do	.....do									27,200	.....do	7.1800	13.08
5192	Lining for cylinder	Feb. 19									19,400	.....do	7.1094	6.91
5197	12" top carriage	Mar. 2									31,420	Fine granular, granitic	7.2041	13.85
5199	.....do	Mar. 6									33,550	.....do	7.1881	13.59

PIG IRONS.

5121	Napier charcoal pig										9,220	Coarse granular		
5125	Rockwood pig		3.136	2.901	0.235	0.497	3.393	0.008	1.287	0.000	11,590	Coarse and fine granulation interspersed.		
5126	Katahdin pig No. 4		3.921	3.236	0.685	0.154	2.961	0.030	0.493	0.000	18,100	.....do		
5127	Katahdin pig No. 4, high		2.945	2.167	0.778	0.116	1.297	0.072	0.477	0.000	24,160	Fine granular		
5129	Katahdin pig No. 4										19,980	Medium coarse granular, containing light-colored spots.		
5130	Katahdin pig										30,100	Fine granular, granitic		
5212	.....do										32,700	Fine granular, gray	7.3224	23.43
5213	.....do										19,980	Coarse granular, dark lustrous	7.1749	9.51
5138	Salisbury pig No. 4		2.901	2.582	0.319	0.477	1.457	0.071	0.327	0.000	24,650	Fine granular	7.2103	13.46
5142	.....do		3.217	2.811	0.406	0.503	0.940	0.070	0.211	0.000	23,910	.....do	7.2678	14.26
5106	.....do										22,260	Fine and medium coarse granulation interspersed.		
5139	Salisbury pig No. 4, high		3.220	2.454	0.766	0.489	1.391	0.061	0.369	0.000	25,520	Fine granular	7.2658	14.26
5143	.....do		3.326	2.658	0.668	0.494	0.883	0.075	0.192	0.000	29,420	.....do	7.2930	15.13
5164	.....do										23,040	.....do		
5214	.....do										28,410	.....do	7.2586	15.43
5215	.....do										26,940	.....do	7.3099	17.08

PIG IRONS—Continued.

No. of test.	Description.	Date of cast.	Chemical composition.								Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.
			Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.				
			Total.	Graphitic.	Combined.									
											Pounds.			
5140	No. 1 Hubbard Scotch pig										8,110	Coarse and fine granulation interspersed.		
5177	Watervliet Arsenal pig		3.111	1.761	1.350	0.240	0.911	0.200	0.440		26,140	Granular, mottled		
5178	....do		3.381	2.781	0.600	0.441	1.250	0.157	0.530		21,980	Granular		
5190	Muirkirk pig No. 4										31,510	Medium fine granular	7.2673	19.08
5216	....do										29,100	Fine granular	7.2572	15.13
5191	Muirkirk pig No. 4, high										31,740	....do	7.2857	18.19
5221	....do										35,540	Fine granular, dark gray	7.2768	19.18
	Richmond pig No. 3					0.464	0.981	0.020	0.382					
	Richmond pig No. 4					0.360	0.592	0.020	0.381					

"SEMI-STEEL" FROM THE FARREL FOUNDRY AND MACHINE COMPANY, ANSONIA, CONN.

Nos. 5170 and 5171 turned down from 1″ square cast bars, Nos. 5172 and 5173 from ½″ round cast bars.

Nos. 5170 and 5171 had stems 2″ long. Nos. 5172 and 5173 were grooved form.

No. of test.	Diameter.	Sectional area.	Tensile strength.		Appearance of fracture.
			Total.	Per square inch.	
	Inches.	*Sq. inches.*	*Pounds.*	*Pounds.*	
5170	.564	.25	12,300	49,200	Fine granular.
5171	.564	.25	11,460	45,840	Do.
5172	1.129	1.00	46,400	46,400	Do.
5173	1.129	1.00	42,820	42,820	Do.

CHAIN CABLE, SHACKLES, AND SWIVELS.

TENSION TESTS OF CHAIN CABLE, SHACKLES, AND SWIVELS FOR UNITED STATES LIGHT-HOUSE INSPECTOR, THIRD DISTRICT.

TESTS OF CHAIN CABLE.

[Samples consist of three studded links each.]

No. of test.	Marks.	Diameter of chain.	Sectional area.	Tensile strength.		Fractured.
				Total.	Per square inch.	
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	
7309	Leb.C.Wks., Lebanon, Pa.	1.78	4.98	205,700	41,310	Middle link in the quarter opposite end from the weld. Fibrous.
7310	.....do.....	1.78	4.98	206,300	41,430	First link in the quarter opposite end from weld. Fibrous.
7311	.....do.....	1.78	4.98	210,000	42,170	Do.
7305	.....do.....	2.03	6.47	270,700	41,840	Do.
7307	.....do.....	2.03	6.47	254,100	39,270	Do.
7308	.....do.....	2.03	6.47	274,050	42,360	Do.
7977	L. C. W., Leb., Pa.....	1.92	5.79	210,300	36,320	First link in the weld. Fibrous.
7976	.....do.....	2.02	6.41	242,300	37,800	Do.
7975	.....do.....	2.02	6.41	250,100	39,020	First link of chain in the quarter opposite welded end. Fibrous.
7980	W. E. R. M. Co., Lebanon, Pa. a	2.13	7.12	291,600	40,950	Studded link at welded end. 50 per cent granular, 50 per cent fibrous.

a Sample consists of only one studded link, two outside links with studs removed.

TESTS OF SHACKLES AND SWIVELS.

No. of test.	Description.	Tensile strength.	Fractured.
		Pounds.	
7978	2″ shackle.....	312,100	At end of loop. Fibrous.
7312	1¾″ swivel.....	213,800	Bale of female part, in the weld.
7313	2″ swivel.....	245,000	Fixture, swivel not fractured.
		262,500	Second fixture, swivel still remained in working order.
		280,300	Male part, at junction of eye and stem. Fibrous, with about 8 per cent of surface granular in streaks.
7979	.....do.....	230,000	Pulled off eye of male part. Weld defective.

TENSION TESTS OF CHAIN CABLE FROM THE BOSTON NAVY-YARD

[Samples consist of 3 studded links of chain.]

No. of test.	Marks.	Diameters.		Sectional area of chain.	Tensile strength.		Fractured.
		End links.	Studded links of chain.		Total.	Per square inch.	
		In.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	
7903	1 N. S. N. Y. B	2.62	2.50	9.82	432,900	44,080	Middle link of chain at the welded end where it followed the scarf in part, the remainder being granular in appearance. The end of the link opposite the weld also fractured with a granular appearance. This fractured link was of steel.
7904	11 N. S. N. Y. B ...	2.62	2.50	9.82	341,500	34,780	First link of chain at the welded end, the line of fracture following the scarf.

CHAINS.

PROOF STRESSES AND CHAIN IRON.

PROOF STRESS OF HOISTING CHAIN IN GENERAL USE AT ARSENAL.

CHAIN TESTED AFTER ANNEALING.

No. 7165.

Chain consists of 40 links of 1″ chain, with outside links 1″.22 and 1″.11 diameter, and larger end links 1″.76 diameter.
Length of chain (1″ links), 9′ 1″.

Applied loads.	Elongation.	Permanent set.	Remarks.
Pounds.	*Inch.*	*Inch.*	
500	0.	0.	Initial load.
1,000	.07	.....	
2,000	.12	.....	
3,000	.15	.....	
4,000	.18	.....	
5,000	.21	.....	
6,000	.23	.....	
7,000	.27	.....	
8,000	.29	.....	
9,000	.30	.....	
10,000	.33	.....	
11,000	.36	.....	
12,000	.38	.....	
13,000	.40	.....	
14,000	.43	.....	
15,000	.46	.15	
16,000	.49	.....	
17,000	.53	.....	
18,000	.58	.25	
19,000	.66	.....	
20,000	.77	.40	Test discontined.

PROOF STRESS APPLIED TO TWO 1″ CHAINS TO BE USED FOR SLINGS.

TESTED AFTER ANNEALING.

No. 7616.

Total length of chain (1″ links), 12′ 1″. Chain was provided with outside links 1″.20 diameter, and end links 1″.75 diameter.

Applied loads.	Elongation.	Permanent set.	Remarks.
Pounds.	*Inches.*	*Inches.*	
500	0.	0.	Initial load.
1,000	.42	.....	
2,000	.59	.....	
3,000	.66	.....	
4,000	.72	.....	
5,000	.79	.19	
6,000	.84	.....	
7,000	.90	.....	
8,000	.97	.32	
9,000	1.04	.....	
10,000	1.11	.43	
11,000	1.18	.49	
12,000	1.51	.69	
13,000	1.61	.....	
14,000	1.73	1.02	
15,000	1.99	.....	
16,000	2.25	1.55	
17,000	2.99	.....	
18,000	3.17	2.38	
19,000	3.80	.....	
20,000	4.21	3.40	Test discontinued.

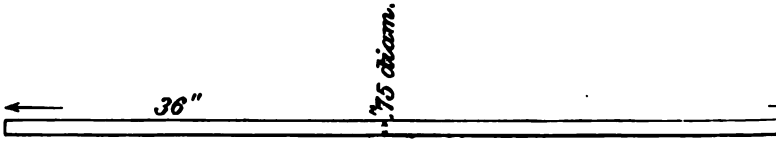
No. 7617.

Total length of chain (1″ links), 12′ 2″. Chain was provided outside and end links of same diameter as No. 7616.

Applied loads.	Elongation.	Permanent set.	Remarks.
Pounds.	*Inches.*	*Inches.*	
500	0.	0.	Initial load.
1,000	.50	.....	
2,000	.67	.....	
3,000	.74	.....	
4,000	.81	.....	
5,000	.87	.18	
6,000	.92	.....	
7,000	.99	.....	
8,000	1.04	.31	
9,000	1.10	.....	
10,000	1.17	.49	
11,000	1.22	.....	
12,000	1.30	.51	
13,000	1.39	.....	
14,000	1.50	.77	
15,000	1.65	.....	
16,000	1.89	1.14	
17,000	2.20	.....	
18,000	2.60	1.84	
19,000	3.08	.....	
20,000	3.57	2.71	Test discontinued.

TENSION TEST OF IRON FROM WHICH CHAINS NOS. 7620 7621 WERE MADE IN ARSENAL SMITH SHOP.

No. 7619.



Sectional area, .442 square inch.
Elastic limit, 12,300 pounds=27,830 pounds per square inch.
Tensile strength, 19,100 pounds=43,210 pounds per square inch
Elongation in 10 inches, 3″.23=32.3 per cent.
Elongation of inch sections, ″.24, ″.24, ″.28, ″.33, ″.81*, ″.37, ″.23, ″.18, ″.25.
Diameter at fracture, ″.38; area, .113 square inch.
Contraction of area, 74.4 per cent.
Appearance of fracture, fibrous.

PROOF STRESSES APPLIED TO TWO THREE-QUARTER INCH SLING CHAINS.

No. 7620.

Total length of chain, 15′ 5″.
Diameter of wire, ″.75.
Sectional area, .88 square inch.
Elongations measured in 100″.

Applied loads.	Elongation.	Permanent set.	Remarks.
Pounds.	*Inches.*	*Inches.*	
1,000	0.	0.	Initial load.
2,000	.....	.....	
3,000	.....	.....	
4,000	.....	.....	
5,000	.....	.....	
6,000	.....	.....	
2,000	.....	.95	
		1.31	After sustaining load 5 minutes.
		1.45	After sustaining load 9 minutes.
			Load released and links moved about.
1,000	.....	1.37	
8,000	1.67	.....	
	1.71	.....	After sustaining load 10 minutes.
1,000	.....	1.47	
			Load released and links moved about.
1,000	.....	1.48	
8,000	1.78	.....	
	1.79	.....	After sustaining load 5 minutes.
1,000	.....	1.55	
			Load released and links moved about.
1,000	.....	1.52	
8,000	1.81	1.58	Test discontinued.

No. 7621.

Total length of chain, 15′ 6½″.
Diameter of wire, ″.75.
Sectional area, .88 square inch.
Elongations measured in 100″.

Applied loads.	Elongation.	Permanent set.	Remarks.
Pounds.	*Inches.*	*Inches.*	
1,000	0.	0.	Initial load.
2,000	.12	.....	
3,000	.23	.....	
4,000	.34	.....	
5,000	.45	.....	
6,000	.60	.....	
7,000	.80	.....	
8,000	1.21	.....	
	1.52	.....	After sustaining load 5 minutes.
	1.50	.....	After sustaining load 10 minutes.
1,000	.....	1.29	
			Load released and links moved about.
1,000	.....	1.24	
8,000	1.54	.....	
	1.57	.....	After sustaining load 5 minutes.
1,000	.....	1.38	
			Load released and links moved about.
1,000	.....	1.32	
8,000	1.61	.....	
	1.63	.....	After sustaining load 5 minutes.
1,000	.....	1.42	
			Load released and links moved about.
1,000	.....	1.36	
8,000	1.66	.....	
	1.68	.....	After sustaining load 5 minutes.
1,000	.....	1.47	
			Load released and links moved about.
1,000	.....	1.45	
8,000	1.69	.....	
	1.73	.....	After sustaining load 5 minutes.
1,000	.....	1.49	
			Test discontinued.

PROOF STRESSES APPLIED TO 15″ GUN-LIFT CHAINS.

No. 7981.

Breech Chain.

Chain consists of 39 links 1″ diameter with outside end links 1″ diameter.

Length over all, 129″.25, measured under the initial load, 2,000 poun

Applied loads.	Elongation.	Permanent set.	Remarks.
Pounds.	*Inches.*	*Inches.*	
2,000	0.	0.	Initial load.
4,000	.20	.....	
6,000	.36	.....	
8,000	.52	.....	
10,000	.64	.....	
12,000	.83	.....	
14,000	1.05	.....	
16,000	1.44	.....	
17,000	1.90	.....	
18,000	2.29	.....	
19,000	2.75	.....	
20,000	3.30	.....	
2,000	.....	3.07	Test discontinued.

No. 7982.

Chain consists of 33 links ″.89 diameter, with outside end links 1″ diameter.

Length over all, 101″.55, measured under the initial load, 2,0 pounds.

Applied loads.	Elongation.	Permanent set.	Remarks.
Pounds.	*Inches.*	*Inches.*	
2,000	0.	0.	Initial load.
4,000	.15	.....	
6,000	.29	.....	
8,000	.41	.....	
9,000	.48	.....	
10,000	.55	.....	
11,000	.65	.....	
12,000	.78	.....	
13,000	1.04	.....	
14,000	1.40	.....	
15,000	1.88	.....	
2,000	.....	1.74	Test discontinued.

BRONZE.

BRONZE TRAY FOR 8″ B. L. RIFLE.

No. 5243.

Marks, No. 2.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 2″.

Composition.... Cu.....per cent.. 55
Zn.....do.... 44.5
Sn.....do.... .5

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	0.	0.	Initial load.
2,500	5,000	.00020	.00020	—.00010	—.00010	
5,000	10,000	.00075	.00055	—.00010	0.	
5,500	11,000	.00090	.00015	.....	.....	
6,000	12,000	.00110	.00020	.....	.....	
6,500	13,000	.00130	.00020	.....	.....	
7,000	14,000	.00160	.00030	.....	.....	
7,500	15,000	.00190	.00030	.00045	.00055	
8,000	16,000	.00220	.00030	.....	.....	
8,500	17,000	.00250	.00030	.....	.....	
9,000	18,000	.00300	.00050	.....	.....	
9,500	19,000	.00345	.00045	.....	.....	
10,000	20,000	.00410	.00065	.00180	.00135	
10,500	21,000	.00455	.00045	.....	.....	
11,000	22,000	.00580	.00125	.....	.....	
11,500	23,000	.00665	.00085	.....	.....	
12,000	24,000	.00765	.00100	.....	.....	
12,500	25,000	.00925	.00160	.00020	.00440	
13,000	26,000	.01095	.00170	.....	.....	
13,500	27,000	.01325	.00230	.....	.....	
14,000	28,000	.01570	.00245	.....	.....	
14,500	29,000	.01835	.00265	.....	.....	
15,000	30,000	.02120	.00285	.01735	.01115	
16,000	32,000	.0250	.0038	.....	.....	
17,000	34,000	.0350	.0100	.....	.....	
18,000	36,000	.0450	.0100	.....	.....	
19,000	38,000	.0500	.0050	.....	.....	
20,000	40,000	.0650	.0150	.....	.....	
21,000	42,000	.0750	.0100	.....	.....	
22,000	44,000	.0850	.0100	.....	.....	
23,000	46,000	.1000	.0150	.....	.....	
23,640	47,280	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	47,280
Elongation per inch after rupture	inch..	.130
Reduction in diameter at point of rupture	do...	.078
Reduction in area after rupture, per cent of original section		18.6
Position of rupture		near middle of stem
Character of broken surface		uniform light yellow color, of lavender shade, vesicular surface
Elongation of inch sections		″.15*, ″.09

BRONZE TRAY FOR 8″ B. L. RIFLE.

Same cast as test No. 5243, annealed.

No. 5248.

Marks, No. 2.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 2″.

Composition.... { Cu ..... per cent.. 55
Zn ..... do.... 44.5
Sn ..... do.... .5

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	0.	0.	Initial load.
2,500	5,000	.00035	.00035	0.	.....	
5,000	10,000	.00085	.00050	0.	.....	
5,500	11,000	.00095	.00010	.....	.....	
6,000	12,000	.00115	.00020	.....	.....	
6,500	13,000	.00130	.00015	.....	.....	
7,000	14,000	.00145	.00015	.....	.....	
7,500	15,000	.00165	.00020	.00025	.00025	
8,000	16,000	.00190	.00025	.....	.....	
8,500	17,000	.00220	.00030	.....	.....	
9,000	18,000	.00255	.00035	.....	.....	
9,500	19,000	.00300	.00045	.....	.....	
10,000	20,000	.00360	.00060	.00145	.00120	
10,500	21,000	.00390	.00030	.....	.....	
11,000	22,000	.00465	.00075	.....	.....	
11,500	23,000	.00550	.00085	.....	.....	
12,000	24,000	.00675	.00125	.....	.....	
12,500	25,000	.00800	.00125	.00520	.00375	
13,000	26,000	.00950	.00150	.....	.....	
13,500	27,000	.01150	.00200	.....	.....	
14,000	28,000	.01370	.00220	.01035	.00515	
15,000	30,000	.0150	.0013	.....	.....	
16,000	32,000	.0250	.0100	.....	.....	
17,000	34,000	.0300	.0050	.....	.....	
18,000	36,000	.0400	.0100	.....	.....	
19,000	38,000	.0500	.0100	.....	.....	
20,000	40,000	.0600	.0100	.....	.....	
21,000	42,000	.0750	.0150	.....	.....	
21,200	42,400	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section ..... pounds.. 42,400
Elongation per inch after rupture ..... inch.. .08
Reduction in diameter at point of rupture ..... do.... .04
Reduction in area after rupture, per cent of original section 11.6
Character of broken surface ..... yellow and lavender colored metal interspersed
Elongation of inch sections ..... ″.07, ″.10

BRONZE TRAY FOR 8″ B. L. RIFLE.

No. 5242.

Marks, No. 1.
Diameter, ″.798.*
Sectional area, .50 square inch.
Gauged length, 2″.

Composition ....

Cu	per cent..	55
Zn	do....	44.5
Sn	do....	.5

Applied loads. Total.	Applied loads. Per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	0.	0.	Initial load.
2,500	5,000	.00025	.00025	0.	.....	
5,000	10,000	.00085	.00060	0.	.....	
5,500	11,000	.00100	.00015	.....	.....	
6,000	12,000	.00120	.00020	.....	.....	
6,500	13,000	.00145	.00025	.....	.....	
7,000	14,000	.00180	.00035	.....	.....	
7,500	15,000	.00215	.00035	.00060	.00060	
8,000	16,000	.00240	.00025	.....	.....	
8,500	17,000	.00270	.00030	.....	.....	
9,000	18,000	.00315	.00045	.....	.....	
9,500	19,000	.00370	.00055	.....	.....	
10,000	20,000	.00425	.00055	.000195	.00135	
10,500	21,000	.00475	.00050	.....	.....	
11,000	22,000	.00565	.00090	.....	.....	
11,500	23,000	.00660	.00095	.....	.....	
12,000	24,000	.00800	.00140	.....	.....	
12,500	25,000	.00935	.00135	.00625	.00430	
13,000	26,000	.01100	.00165	.....	.....	
13,500	27,000	.01320	.00220	.....	.....	
14,000	28,000	.01560	.00240	.....	.....	
14,500	29,000	.01845	.00285	.....	.....	
15,000	30,000	.2150	.00305	.01750	.01125	
16,000	32,000	.0300	.0085	.....	.....	
17,000	34,000	.0350	.0050	.....	.....	
18,000	36,000	.0450	.0100	.....	.....	
19,000	38,000	.0550	.0100	.....	.....	
19,210	38,420	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds.. 38,420
Elongation per inch after rupture	inch.. .075
Reduction in diameter at point of rupture	do... .058
Reduction in area after rupture, per cent of original section	14.0
Position of rupture	near middle of stem
Character of broken surface	lavender-colored, with stellar spot of yellow metal at center
Elongation of inch sections	″.10*, ″.05

BRONZE TRAY FOR 8″ B. L. RIFLE.

Same cast as No. 5242, annealed.

No. 5247.

Marks, No. 1.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
500	1,000	0.	0.	0.	0.	Initial load.
2,500	5,000	.00035	.00035	0.	.....	
5,000	10,000	.00085	.00050	.00305	.00005	
5,500	11,000	.00100	.00015	.....	.....	
6,000	12,000	.00110	.00010	.....	.....	
6,500	13,000	.00125	.00015	.....	.....	
7,000	14,000	.00135	.00010	.....	.....	
7,500	15,000	.00170	.00035	.00030	.00025	
8,000	16,000	.00200	.00030	.....	.....	
8,500	17,000	.00235	.00035	.....	.....	
9,000	18,000	.00275	.00040	.....	.....	
9,500	19,000	.00330	.00055	.....	.....	
10,000	20,000	.00385	.00055	.00170	.00140	
10,500	21,000	.00445	.00060	.....	.....	
11,000	22,000	.00515	.00100	.....	.....	
11,500	23,000	.00675	.00130	.....	.....	
12,000	24,000	.00805	.00130	.....	.....	
12,500	25,000	.01020	.00215	.00725	.00555	
13,000	26,000	.01135	.00115	.....	.....	
13,500	27,000	.01475	.00340	.01145	.00420	
14,000	28,000	.0200	.00525	.....	.....	
14,400	28,800	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....pounds.. 28,
Elongation per inch after rupture.....inch..
Reduction in diameter at point of rupture.....do...
Reduction in area after rupture, per cent of original section..... 9.
Character of broken surface.....yellow metal with lavender-colored metal interspersed. Oper
minute cracks in surface of stem.
Elongation of inch sections..... ″.02, ″.

BRONZE TRAY FOR 8″ B. L. RIFLE.

No. 5250.

Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 2″.

Composition.... Cu.....per cent.. 55
Zn.....do 44.5
Sn.....do 5

Applied loads. Total.	Applied loads. Per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
500	1.000	0.	0.	0.	0.	Initial load.
2.500	5.000	.00050	.00050	0.	.....	
5.000	10.000	.00100	.00050	0.	.....	
5.500	11.000	.00110	.00010	.....	.....	
6.000	12.000	.00125	.00015	.....	.....	
6.500	13.000	.00150	.00025	.....	.....	
7.000	14.000	.00175	.00025	.....	.....	
7.500	15.000	.00200	.00025	.00015	.00015	
8.000	16.000	.00230	.00030	.....	.....	
8.500	17.000	.00260	.00030	.....	.....	
9.000	18.000	.00290	.00030	.....	.....	
9.500	19.000	.00340	.00050	.....	.....	
10.000	20.000	.00385	.00045	.00160	.00115	
10.500	21.000	.00430	.00045	.....	.....	
11.000	22.000	.00495	.00065	.....	.....	
11.500	23.000	.00580	.00085	.....	.....	
12.000	24.000	.00675	.00095	.....	.....	
12.500	25.000	.00805	.00130	.....	.....	
13.000	26.000	.00940	.00135	.....	.....	
13.500	27.000	.01135	.00195	.....	.....	
14.000	28.000	.01330	.00195	.....	.....	
14.500	29.000	.01580	.00250	.....	.....	
15.000	30.000	.01800	.00220	.....	.....	
16.000	32.000	.025	.007	.....	.....	
17.000	34.000	.030	.005	.....	.....	
18.000	36.000	.040	.010	.....	.....	
19.000	38.000	.050	.010	.....	.....	
20.000	40.000	.060	.010	.....	.....	
21.000	42.000	.070	.010	.....	.....	
22.000	44.000	.080	.010	.....	.....	
23.000	46.000	.095	.015	.....	.....	
23.240	46.480	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	46,480
Elongation per inch after rupture	inch..	.110
Reduction in diameter at point of rupture	do....	.048
Reduction in area after rupture, per cent of original section		11.6
Character of broken surface		uniform light yellow color, vesicular surface
Elongation of inch sections		″.10, ″.13*

BRONZE FROM CYLINDER LINING OF 12″ GUN-LIFT CARRIA

Specimen turned down from bar 1½″ diameter.

No. 5228.

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Composition.... Cu.....per cent.. 88
Sn.....do.... 8
Zn.....do.... 4

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000300	.000300	.....	.....	
1,500	6,000	.000367	.000067	.....	.....	
1,750	7,000	.000433	.000066	.....	.....	
2,000	8,000	.000567	.000134	.....	.....	
2,250	9,000	.000667	.000100	.....	.....	
2,500	10,000	.000700	.000033	.....	.....	
2,750	11,000	.000767	.000067	.....	.....	Elastic limit.
3,000	12,000	.000967	.000200	.....	.....	
3,250	13,000	.001167	.000200	.....	.....	
3,500	14,000	.001600	.000433	.....	.....	
3,750	15,000	.002333	.000733	.....	.....	
4,000	16,000	.004267	.001934	.....	.....	
4,250	17,000	.007700	.003433	.....	.....	
4,500	18,000	.011500	.003800	.....	.....	
4,750	19,000	.018000	.006500	.....	.....	
5,000	20,000	.025333	.007333	.....	.....	
5,250	21,000	.034333	.014000	.....	.....	
5,500	22,000	.043667	.009334	.....	.....	
5,650	22,600	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....pounds..
Elastic limit per square inch of original section.....do...
Elongation per inch after rupture.....inch..
Elongation per inch under strain at elastic limit.....do...
Reduction in diameter at point of rupture.....do...
Reduction in area after rupture, per cent of original section.....
Position of rupture..... 1″.33 from
Character of broken surface..... dark

SPECIMEN TURNED FROM A BAR 1″ DIAMETER.

No. 5249.

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Composition .... { Cu ..... per cent.. 60
Zn ..... do.... 40

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000267	.000267	0.	.....	
2,500	10,000	.000667	.000400	0.	.....	
2,750	11,000	.000800	.000133	.....	.....	Elastic limit.
3,000	12,000	.001067	.000267	.....	.....	
3,250	13,000	.001367	.000300	.....	.....	
3,500	14,000	.002667	.001300	.....	.....	
3,750	15,000	.004533	.001866	.003033	.003033	
4,000	16,000	.007333	.002800	.....	.....	
4,250	17,000	.010000	.002667	.....	.....	
4,500	18,000	.015000	.005000	.....	.....	
4,750	19,000	.019667	.003667	.....	.....	
5,000	20,000	.025367	.005700	.022067	.019034	
5,250	21,000	.0300	.004633	.....	.....	
5,500	22,000	.0367	.0067	.....	.....	
5,750	23,000	.0433	.0066	.....	.....	
6,000	24,000	.0500	.0067	.....	.....	
6,250	25,000	.0567	.0067	.....	.....	
6,500	26,000	.0633	.0066	.....	.....	
6,750	27,000	.0700	.0067	.....	.....	
7,000	28,000	.0800	.0100	.....	.....	
7,250	29,000	.0933	.0133	.....	.....	
7,500	30,000	.1067	.0134	.....	.....	
7,850	31,400	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	31,400
Elastic limit per square inch of original section	do...	11,000
Elongation per inch after rupture	inch..	.120
Elongation per inch under strain at elastic limit	do...	.000800
Reduction in diameter at point of rupture	do...	.064
Reduction in area after rupture, per cent of original section		21.4
Character of broken surface		lavender-colored metal with yellow center
Elongation of inch sections		″.10, ″.11, ″.16

BRONZE TRAY FOR 12″ B. L. RIFLE.

No. 5233.

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Composition ..... { Cu ..... per cent.. 55.
Zn ..... do 44.5
Sn ..... do 5

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0,	Initial load.
1,250	5,000	.000300	.000300	.000033	.000033	
2,500	10,000	.000833	.000533	.000067	.000034	Elastic limit.
2,750	11,000	.000967	.000134	.....	.....	
3,000	12,000	.001167	.000200	.....	.....	
3,250	13,000	.001367	.000200	.....	.....	
3,500	14,000	.001633	.000266	.....	.....	
3,750	15,000	.001867	.000234	.000400	.000333	
4,000	16,000	.002233	.000366	.....	.....	
4,250	17,000	.002400	.000167	.....	.....	
4,500	18,000	.002833	.000433	.....	.....	
4,750	19,000	.003167	.000334	.....	.....	
5,000	20,000	.003733	.000566	.001633	.001233	
5,250	21,000	.004000	.000267	.....	.....	
5,500	22,000	.004967	.000967	.....	.....	
5,750	23,000	.005633	.000666	.....	.....	
6,000	24,000	.007000	.000367	.....	.....	
6,250	25,000	.008333	.001333	.005400	.003767	
6,500	26,000	.009933	.001600	.....	.....	
6,750	27,000	.011333	.001400	.....	.....	
7,000	28,000	.014000	.002667	.....	.....	
7,250	29,000	.016167	.002167	.....	.....	
7,500	30,000	.018967	.002800	.....	.....	
8,000	32,000	.0233	.004333	.....	.....	
8,490	33,960	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of orininal section ..... pounds..
Elastic limit per square inch of original section ..... do...
Elongation per inch after rupture ..... inch..
Elongation per inch under strain at elastic limit ..... do...
Reduction in diameter at point of rupture ..... do...
Reduction in area after rupture, per cent of original section .....
Position of rupture ..... 1″.5 from
Character of broken surface..... lavender colored at the circumference, with radiant yellow
Elongation of inch sections ..... ″.03, ″.0

BRONZE TRAY FOR 12″ B. L. RIFLE.

Specimen taken from bar about 1½″ diameter.

No. 5239.

Diameter, ″.564.
Sectional area .25 square inch.
Gauged length, 3″.

Composition ....
- Cu ..... per cent.. 55
- Zn ..... do.... 44.5
- Sn ..... do.... .5

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000367	.000367	0.	.....	
2,500	10,000	.000767	.000400	0.	.....	
2,750	11,000	.000867	.000100	.....	.....	
3,000	12,000	.001000	.000133	.....	.....	
3,250	13,000	.001167	.000167	.....	.....	
3,500	14,000	.001300	.000133	.....	.....	
3,750	15,000	.001367	.000067	.000100	.000100	Elastic limit.
4,000	16,000	.001633	.000266	.....	.....	
4,250	17,000	.001900	.000267	.....	.....	
4,500	18,000	.002100	.000200	.....	.....	
4,750	19,000	.002333	.000233	.....	.....	
5,000	20,000	.002667	.000334	.000700	.000600	
5,250	21,000	.003000	.000333	.....	.....	
5,500	22,000	.003667	.000667	.....	.....	
5,750	23,000	.004033	.000366	.....	.....	
6,000	24,000	.004733	.000700	.....	.....	
6,250	25,000	.005333	.000600	.002667	.001967	
6,500	26,000	.006667	.001334	.....	.....	
6,750	27,000	.007833	.001166	.....	.....	
7,000	28,000	.009667	.001834	.....	.....	
7,250	29,000	.011000	.001333	.....	.....	
7,500	30,000	.013400	.002400	.010000	.007333	
8,000	32,000	.0167	.0033	.....	.....	
8,500	34,000	.0233	.0066	.....	.....	
9,000	36,000	.0300	.0067	.....	.....	
9,230	36,920	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	36,920
Elastic limit per square inch of original section	do...	15,000
Elongation per inch after rupture	inch..	.0400
Elongation per inch under strain at elastic limit	do...	.001367
Reduction in diameter at point of rupture	do...	.034
Reduction in area after rupture, per cent of original section		11.8
Position of rupture		″.50 from neck
Character of broken surface....	40 per cent light lavender color, interspersed with 60 per cent yellow metal, spongy near the center.	
Elongation of inch sections		″.02, ″.03, ″.07*

TABULATION OF BRONZE FROM WATERTOWN ARSENAL FOUNDRY.

Number of test.	Description.	Composition.			Diameter.	Sectional area.	Tensile strength per square inch.	Gauged length.	Elongation in gauged length.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
		Cu.	Zn.	Sn.								
		Per ct.	*Per ct.*	*Per ct.*	*Inch.*	*Sq. in.*	*Pounds.*	*Inches.*	*Per ct.*	*Per ct.*		" "
5242	8" tray No. 1	55	44.5	.5	.798	.50	38,420	2	7.5	14.0	Lavender colored, with stellar spot of yellow metal at center.	.10*, .05
5242*a*	do	55	44.5	.5	.564	.25	42,120	1	11.0	15.1	Lavender color, interspersed with yellow metal.	
5247	8" tray No. 1, annealed	55	44.5	.5	.798	.50	28,800	2	2.5	9.2	Yellow metal, with lavender-colored metal interspersed.	.02, .03*
5243	8" tray No. 2	55	44.5	.5	.798	.50	47,280	2	13.0	18.6	Uniform light-yellow color, of lavender shade, vesicular surface.	.15*, .09
5243*a*	do	55	44.5	.5	.564	.25	42,320	1	6.0		Yellow and lavender-colored metal interspersed.	
5248	8" tray No. 2, annealed	55	44.5	.5	.798	.50	42,400	2	8.5	11.6	do	.07, .10*
5250	8" tray No. 3	55	44.5	.5	.798	.50	46,480	2	11.0	11.6	Uniform light-yellow color, vesicular surface.	.10, .13*
5252	8" tray No. 4	57.5	42	.5	.564	.25	35,760	2	8.0	15.0	Yellow metal, with patches of lavender color.	.07, .09*
5254	do	57.5	42	.5	.564	.25	46,800	2	25.5	30.8	Uniform lavender color	.31*, .20
5256	8" tray No. 5	57.5	42	.5	.564	.25	52,800	2	20.5		Lavender color, 10 per cent yellow metal	
5257	8" tray No. 6	57.5	42	.5	.798	.50	55,020	2	32.5	33.6	Uniform light-yellow metal	.37*, .28
5258	8" tray No. 7	57.5	42	.5	.798	.50	55,180	2	34.0	33.6	do	.28, .40*
5259	8" tray No. 8	57.5	42	.5	.798	.50	55,360	2	33.0	31.6	do	.34*, .32
	10" tray No. 1	57.5	42	.5	.564	.25	44,720	2	15.5	21.4	Lavender colored, 90 per cent; light yellow, 10 per cent.	
	do	57.5	42	.5	.564	.25	28,640					
	do	57.5	42	.5	.564	.25	49,960	2	55.0	49.7	Light yellow, with small dark-colored porus spots.	
	10" tray No. 2	57.5	42	.5	.564	.25	42,400	2	11.5	5.4	Lavender, interspersed with light-yellow metal.	
	do	57.5	42	.5	.564	.25	53,600	2	42.5	39.2		
	10" tray No. 3	57.5	42	.5	.564	.25	52,800	2	24.0	27.6	Lavender colored	
	10" tray	57.5	42	.5	.564	.25	44,400	2	14.0	21.4	Lavender and light yellow	
	10" tray No. 4	57.5	42	.5	.564	.25	57,520	2	41.5	36.4	Uniform light-yellow color	
	10" tray No. 5	57.5	42	.5	.564	.25	32,840	2	7	18.3	Light-yellow and lavender-colored metal interspersed.	
	do	57.5	42	.5	.564	.25	36,040	2	6.5	15.0	25 per cent light-yellow spongy; 75 per cent lavender colored.	
	Second 10" tray No. 5	57.5	42	.5	.564	.25	56,000	2	37.5	41.9		
5228	Cylinder lining for 12" carriage.	88	8	4	.564	.25	22,600	3	6.7	11.8	Dark yellow	
5265	8" shot tray	55	44.5	.5	.564	.25	32,480	3	5.3	11.6	Yellow metal, with shade of lavender; small blowhole in fractured surface.	

	.....do	57.5	42	.5	.564	.25	49,280	2	25.0	33.5	Light lavender and yellow metal	
5266	Elevating rack, 10" carriage.	57.5	42	.5	.564	.25	52,440	3	20.7	30.6	Uniform light-yellow metal	
5249	Bar 1" diameter	60	40	.....	.564	.25	31,400	3	12.0	21.4	Lavender and yellow-colored metal	
5233	12" tray	55	44.5	.5	.564	.25	33,960	3	4.0	8.4	Lavender colored at the circumference, with radiant yellow center.	.03, .06*, .03
5233a	.....do	55	44.5	.5	.490	.189	44,550	2	11.0	23.3	Light lavender color, vesicular surface; spongy metal on one side.	.09, .18*
5239	.....do	55	44.5	.5	.564	.25	36,920	3	4.0	11.8	Light lavender color, interspersed with yellow metal.	.02, .03, .07*
5239a	.....do	55	44.5	.5	.564	.25	45,360	1	17.0	15.0	.....do	
5260	12" tray No. 1	57.5	42	.5	.798	.50	52,960	2	27.5	29.4	Uniform light yellow	.34*, .21*
5261	12" tray No. 2	57.5	42	.5	.798	.50	54,820	2	28.5	25.2	.....do	.29*, .28
5267	Second 12" tray No. 1	57.5	42	.5	.564	.25	53,280	3	24.0	27.6	.....do	.24, .28*, .20
5268	Second 12" tray No. 2	57.5	42	.5	.564	.25	50,560	3	19.3	27.6	.....do	.15, .19, .24*
5269	12" tray No. 3	57.5	42	.5	.564	.25	52,720	3	24.0	24.6	.....do	.21, .23, .28*
5270	12" tray No. 4	57.5	42	.5	.564	.25	55,680	3	26.0	33.5	.....do	.21, .24, .33*
5271	12" tray No. 5	57.5	42	.5	.564	.25	52,640	3	26.0	30.6	.....do	.32*, .21, .15
5271a	12" tray No. 6	57.5	42	.5	.564	.25	53,560	3	23.8	27.6	.....do	.18, .20, .32*
5271b	12" tray No. 7	57.5	42	.5	.564	.25	44,800	3	12.7	18.3	Yellow and lavender-colored metal interspersed.	.11, .11, .16*
5271c	12" tray No. 8	57.5	42	.5	.564	.25	51,920	3	41.0	36.4	Uniform light yellow	.45*, .40, .38

COPPER CYLINDERS FOR PRESSURE GAUGES.

COPPER CYLINDERS FOR PRESSURE GAUGES.

No. 7434.

Mean compression of 10 copper cylinders from lot of 1,474 received from Frankford Arsenal September 12, 1894.

Copper purchased in 1889.

Table for use with crusher gauge, one-tenth square inch area.

Mean dimensions of coppers: Length, ".5002; diameter, ".2519.

Load per square inch, pounds.	Total compression.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1,000	.0080	.0056	.0075	.0070	.0070	.0069	.0071	.0080	.0079	.0080	.0073	.0071
2,000	.0190	.0180	.0189	.0152	.0180	.0170	.0180	.0178	.0186	.0184	.0182	.0177
3,000	.0320	.0225	.0208	.0210	.0220	.0225	.0214	.0225	.0218	.0229	.0219	.0214
4,000	.0462	.0265	.0259	.0264	.0259	.0248	.0250	.0264	.0258	.0265	.0259	.0254
5,000	.0609	.0310	.0303	.0304	.0301	.0296	.0295	.0312	.0309	.0314	.0305	.0298
6,000	.0753	.0352	.0347	.0345	.0345	.0343	.0344	.0355	.0352	.0358	.0349	.0342
7,000	.0900	.0409	.0397	.0394	.0397	.0390	.0393	.0400	.0399	.0410	.0399	.0392
8,000	.1052	.0450	.0445	.0450	.0449	.0445	.0450	.0458	.0456	.0460	.0451	.0441
9,000	.1204	.0505	.0500	.0494	.0495	.0489	.0489	.0513	.0503	.0515	.0502	.0491
10,000	.1358	.0560	.0548	.0545	.0546	.0550	.0550	.0563	.0558	.0565	.0554	.0543
11,000	.1519	.0625	.0618	.0595	.0605	.0595	.0610	.0622	.0613	.0630	.0613	.0602
12,000	.1676	.0676	.0660	.0661	.0669	.0655	.0664	.0677	.0664	.0681	.0668	.0657
13,000	.1830	.0738	.0709	.0720	.0730	.0720	.0720	.0740	.0722	.0742	.0727	.0716
14,000	.1990	.0787	.0785	.0770	.0773	.0765	.0777	.0800	.0782	.0802	.0784	.0773
15,000	.2160	.0852	.0840	.0835	.0825	.0840	.0835	.0860	.0835	.0859	.0844	.0833
16,000	.2325	.0905	.0905	.0890	.0890	.0891	.0905	.0927	.0900	.0930	.0907	.0896
17,000	.2485	.0970	.0970	.0950	.0956	.0965	.0965	.0984	.0958	.0989	.0969	.0957
18,000	.2649	.1035	.1028	.1015	.1021	.1017	.1026	.1050	.1019	.1050	.1031	.1019
19,000	.2815	.1096	.1095	.1075	.1079	.1088	.1088	.1110	.1089	.1110	.1094	.1082
20,000	.2981	.1159	.1155	.1140	.1139	.1145	.1160	.1175	.1152	.1180	.1159	.1147
21,000	.3145	.1220	.1220	.1195	.1196	.1210	.1230	.1244	.1214	.1248	.1222	.1210
22,000	.3311	.1275	.1280	.1256	.1270	.1265	.1284	.1300	.1270	.1302	.1280	.1268
23,000	.3475	.1348	.1345	.1330	.1334	.1345	.1340	.1365	.1335	.1365	.1348	.1335
24,000	.3640	.1405	.1410	.1389	.1390	.1410	.1396	.1420	.1397	.1429	.1408	.1395
25,000	.3805	.1465	.1465	.1446	.1454	.1449	.1465	.1485	.1460	.1494	.1467	.1454
26,000	.3970	.1528	.1526	.1509	.1520	.1520	.1530	.1547	.1522	.1559	.1531	.1518
27,000	.4135	.1582	.1580	.1570	.1569	.1573	.1582	.1610	.1581	.1629	.1589	.1576
28,000	.4300	.1640	.1645	.1622	.1635	.1630	.1645	.1665	.1641	.1677	.1647	.1643
29,000	.4465	.1695	.1703	.1680	.1690	.1698	.1690	.1723	.1700	.1738	.1705	.1691
30,000	.4630	.1750	.1755	.1740	.1745	.1750	.1752	.1776	.1762	.1786	.1760	.1746
31,000	.4795	.1808	.1815	.1793	.1797	.1816	.1812	.1824	.1813	.1849	.1817	.1803
32,000	.4960	.1860	.1868	.1850	.1855	.1865	.1864	.1891	.1870	.1906	.1872	.1858
33,000	.5125	.1920	.1925	.1900	.1906	.1923	.1915	.1955	.1915	.1960	.1926	.1912
34,000	.5290	.1975	.1975	.1955	.1960	.1975	.1966	.2000	.1970	.2015	.1979	.1965
35,000	.5455	.2025	.2028	.2005	.2015	.2035	.2016	.2045	.2020	.2066	.2031	.2017
36,000	.5620	.2069	.2070	.2065	.2059	.2080	.2060	.2092	.2068	.2110	.2077	.2063
37,000	.5785	.2126	.2126	.2107	.2110	.2127	.2112	.2140	.2124	.2156	.2127	.2113
38,000	.5950	.2169	.2167	.2155	.2155	.2157	.2159	.2191	.2170	.2212	.2172	.2158
39,000	.6115	.2212	.2220	.2200	.2202	.2228	.2205	.2235	.2215	.2257	.2221	.2207
40,000	.6280	.2256	.2261	.2249	.2250	.2270	.2249	.2277	.2260	.2305	.2266	.2252
41,000	.6445	.2302	.2307	.2285	.2292	.2312	.2290	.2322	.2298	.2346	.2308	.2294
42,000	.6610	.2340	.2342	.2335	.2339	.2353	.2330	.2365	.2340	.2386	.2349	.2335
43,000	.6775	.2385	.2381	.2369	.2369	.2393	.2372	.2405	.2383	.2430	.2389	.2375
44,000	.6940	.2426	.2429	.2419	.2411	.2437	.2415	.2442	.2420	.2465	.2432	.2418
45,000	.7105	.2459	.2466	.2450	.2453	.2473	.2454	.2488	.2456	.2509	.2471	.2457
46,000	.7270	.2497	.2500	.2485	.2485	.2510	.2493	.2516	.2494	.2540	.2504	.2490
47,000	.7435	.2535	.2534	.2525	.2523	.2536	.2536	.2549	.2528	.2572	.2539	.2525
48,000	.7600	.2575	.2566	.2559	.2559	.2575	.2561	.2586	.2561	.2608	.2574	.2560
49,000	.7765	.2604	.2605	.2594	.2591	.2614	.2594	.2620	.2600	.2642	.2609	.2596
50,000	.7930	.2636	.2635	.2625	.2625	.2644	.2626	.2652	.2630	.2674	.2640	.2627
51,000	.8095	.2665	.2666	.2655	.2655	.2670	.2659	.2689	.2662	.2708	.2671	.2658
52,000	.8260	.2695	.2697	.2685	.2684	.2707	.2690	.2718	.2696	.2734	.2702	.2689
53,000	.8425	.2725	.2727	.2714	.2714	.2738	.2718	.2744	.2716	.2760	.2730	.2717
54,000	.8590	.2752	.2755	.2742	.2740	.2760	.2749	.2774	.2750	.2791	.2758	.2745
55,000	.8755	.2781	.2780	.2771	.2770	.2788	.2776	.2804	.2780	.2820	.2787	.2774

No. 7434—Continued.

Load per square inch on crusher gauge one-tenth square inch area.	Total compression.											Mea cor rect set
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inc*
63,000	.2825	.2809	.2808	.2798	.2798	.2819	.2805	.2831	.2806	.2845	.2814	.28
64,000	.2851	.2835	.2836	.2826	.2825	.2845	.2831	.2856	.2835	.2874	.2841	.28
65,000	.2878	.2864	.2860	.2850	.2853	.2870	.2855	.2881	.2859	.2900	.2867	.28
66,000	.2901	.2890	.2885	.2879	.2878	.2895	.2881	.2905	.2884	.2925	.2892	.28
67,000	.2930	.2916	.2910	.2901	.2905	.2926	.2910	.2931	.2910	.2948	.2919	.29
68,000	.2951	.2936	.2936	.2925	.2927	.2946	.2931	.2954	.2931	.2970	.2941	.29
69,000	.2972	.2957	.2956	.2952	.2948	.2970	.2951	.2975	.2956	.2995	.2963	.29
70,000	.2993	.2979	.2980	.2974	.2970	.2991	.2975	.3000	.2975	.3016	.2985	.29
71,000	.3015	.3001	.3001	.2995	.2992	.3015	.3001	.3023	.3000	.3039	.3008	.29
72,000	.3038	.3024	.3025	.3015	.3015	.3035	.3024	.3044	.3020	.3059	.3030	.30
73,000	.3060	.3042	.3046	.3037	.3037	.3055	.3045	.3065	.3043	.3080	.3051	.30
74,000	.3080	.3062	.3069	.3055	.3058	.3079	.3065	.3088	.3065	.3102	.3072	.30
75,000	.3100	.3084	.3086	.3077	.3079	.3099	.3085	.3108	.3081	.3121	.3092	.30
76,000	.3120	.3101	.3110	.3095	.3099	.3118	.3105	.3128	.3105	.3144	.3112	.31
77,000	.3139	.3122	.3126	.3115	.3114	.3139	.3125	.3149	.3124	.3161	.3131	.31
78,000	.5156	.3140	.3140	.3135	.3135	.3155	.3145	.3165	.3141	.3180	.3149	.31
79,000	.3177	.3161	.3160	.3153	.3152	.3175	.3163	.3184	.3160	.3197	.3168	.31
80,000	.3195	.3178	.3180	.3167	.3169	.3190	.3179	.3202	.3179	.3215	.3185	.31
81,000	.3211	.3196	.3198	.3188	.3189	.3209	.3200	.3220	.3197	.3231	.3204	.31
82,000	.3231	.3215	.3214	.3207	.3206	.3227	.3215	.3236	.3215	.3248	.3221	.32
83,000	.3246	.3231	.3230	.3225	.3224	.3244	.3231	.3255	.3230	.3265	.3238	.32
84,000	.3260	.3246	.3249	.3242	.3240	.3260	.3245	.3268	.3245	.3283	.3254	.32
85,000	.3275	.3260	.3265	.3257	.3255	.3274	.3264	.3284	.3261	.3300	.3269	.32
86,000	.3290	.3275	.3280	.3272	.3270	.3289	.3280	.3302	.3279	.3314	.3285	.32
87,000	.3305	.3293	.3294	.3285	.3284	.3305	.3298	.3316	.3295	.3327	.3300	.32
88,000	.3324	.3306	.3306	.3301	.3300	.3320	.3313	.3331	.3309	.3341	.3315	.33
89,000	.3335	.3323	.3324	.3319	.3315	.3334	.3327	.3345	.3324	.3356	.3330	.33
90,000	.3348	.3338	.3338	.3332	.3329	.3349	.3339	.3360	.3340	.3370	.3344	.33
91,000	.3362	.3350	.3352	.3347	.3344	.3360	.3354	.3374	.3353	.3386	.3358	.33
92,000	.3376	.3362	.3365	.3360	.3355	.3375	.3367	.3391	.3368	.3398	.3372	.33
93,000	.3386	.3376	.3379	.3374	.3367	.3390	.3380	.3404	.3380	.3411	.3385	.33
94,000	.3400	.3390	.3391	.3388	.3382	.3405	.3397	.3418	.3392	.3424	.3399	.33
95,000	.3415	.3402	.3407	.3400	.3395	.3416	.3409	.3430	.3405	.3440	.3412	.34
96,000	.3428	.3415	.3418	.3413	.3410	.3429	.3420	.3442	.3420	.3450	.3425	.34
97,000	.3441	.3426	.3429	.3426	.3422	.3440	.3434	.3455	.3433	.3461	.3437	.34
98,000	.3452	.3440	.3440	.3438	.3434	.3451	.3446	.3465	.3444	.3473	.3448	.34
99,000	.3465	.3451	.3451	.3450	.3446	.3465	.3456	.3479	.3453	.3485	.3460	.34
100,000	.3475	.3462	.3465	.3461	.3456	.3476	.3470	.3491	.3466	.3496	.3472	.34

No. 7905.

n of 10 copper cylinders from lot of 1,100 received
rsenal April 25, 1895, for the inspector of ordnance,
orks.
l in 1893.
h crusher gauge one-tenth square inch area.
of coppers: Length, ".4996; diameter, ".2518.

Total compression.									Mean corrected sets.
3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Inch.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
.0017	.0018	.0030	.0025	.0028	.0021	.0038	.0016	.0024	.0022
.0118	.0110	.0135	.0120	.0131	.0120	.0153	.0100	.0124	.0119
.0150	.0148	.0159	.0152	.0159	.0154	.0178	.0134	.0155	.0149
.0194	.0189	.0209	.0196	.0200	.0192	.0219	.0176	.0197	.0191
.0226	.0227	.0235	.0232	.0245	.0234	.0256	.0212	.0234	.0227
.0275	.0270	.0286	.0280	.0289	.0286	.0298	.0255	.0280	.0272
.0314	.0305	.0335	.0318	.0330	.0321	.0344	.0302	.0322	.0313
.0355	.0352	.0379	.0364	.0375	.0365	.0384	.0340	.0365	.0355
.0400	.0396	.0424	.0410	.0428	.0411	.0430	.0385	.0411	.0400
.0445	.0444	.0470	.0460	.0465	.0455	.0480	.0429	.0456	.0445
.0500	.0486	.0520	.0505	.0519	.0506	.0521	.0478	.0504	.0493
.0537	.0536	.0564	.0549	.0560	.0548	.0575	.0524	.0550	.0539
.0589	.0580	.0609	.0600	.0611	.0598	.0620	.0567	.0597	.0586
.0623	.0630	.0660	.0646	.0664	.0647	.0670	.0618	.0645	.0634
.0674	.0670	.0718	.0698	.0710	.0699	.0719	.0660	.0694	.0683
.0725	.0725	.0763	.0749	.0758	.0742	.0776	.0716	.0744	.0733
.0764	.0763	.0816	.0797	.0807	.0800	.0820	.0765	.0792	.0780
.0815	.0824	.0866	.0852	.0854	.0848	.0870	.0805	.0842	.0830
.0864	.0866	.0914	.0900	.0907	.0892	.0918	.0864	.0891	.0879
.0915	.0914	.0964	.0953	.0959	.0957	.0969	.0901	.0942	.0930
.0960	.0960	.1020	.1002	.1011	.0996	.1021	.0959	.0991	.0979
.1015	.1021	.1069	.1054	.1063	.1010	.1076	.1008	.1041	.1029
.1063	.1075	.1134	.1102	.1118	.1095	.1128	.1060	.1096	.1083
.1110	.1119	.1171	.1164	.1165	.1150	.1170	.1106	.1144	.1131
.1169	.1169	.1224	.1209	.1221	.1205	.1231	.1161	.1198	.1185
.1209	.1230	.1275	.1261	.1272	.1270	.1280	.1206	.1249	.1236
.1256	.1271	.1335	.1310	.1320	.1309	.1350	.1265	.1300	.1287
.1309	.1324	.1380	.1359	.1365	.1360	.1380	.1305	.1347	.1333
.1354	.1370	.1426	.1398	.1414	.1395	.1430	.1354	.1392	.1378
.1404	.1416	.1469	.1450	.1455	.1455	.1476	.1395	.1438	.1424
.1447	.1459	.1524	.1496	.1516	.1494	.1526	.1445	.1488	.1474
.1489	.1506	.1580	.1549	.1554	.1544	.1570	.1489	.1535	.1521
.1533	.1548	.1625	.1599	.1605	.1596	.1628	.1536	.1584	.1570
.1575	.1592	.1666	.1645	.1655	.1640	.1674	.1589	.1628	.1614
.1620	.1642	.1714	.1690	.1700	.1689	.1726	.1630	.1676	.1662
.1669	.1689	.1760	.1740	.1745	.1739	.1773	.1679	.1723	.1709
.1719	.1730	.1815	.1786	.1790	.1787	.1820	.1728	.1772	.1758
.1756	.1785	.1858	.1840	.1842	.1834	.1872	.1775	.1819	.1805
.1808	.1825	.1912	.1886	.1884	.1879	.1920	.1820	.1866	.1852
.1852	.1871	.1953	.1935	.1938	.1929	.1965	.1870	.1912	.1898
.1890	.1920	.1998	.1987	.1980	.1975	.2009	.1910	.1957	.1943
.1936	.1964	.2046	.2026	.2020	.2018	.2054	.1961	.2002	.1988
.1980	.2014	.2082	.2076	.2071	.2059	.2097	.2009	.2047	.2033
.2020	.2048	.2129	.2124	.2118	.2106	.2140	.2043	.2090	.2076
.2065	.2091	.2163	.2158	.2159	.2148	.2180	.2085	.2132	.2118
.2105	.2128	.2215	.2200	.2195	.2190	.2223	.2128	.2171	.2157
.2146	.2171	.2250	.2240	.2239	.2224	.2265	.2166	.2210	.2196
.2183	.2214	.2288	.2277	.2275	.2263	.2296	.2205	.2248	.2234
.2222	.2251	.2325	.2320	.2316	.2297	.2337	.2247	.2287	.2274
.2255	.2286	.2350	.2350	.2345	.2338	.2369	.2280	.2321	.2308
.2291	.2324	.2391	.2385	.2381	.2370	.2405	.2320	.2357	.2344
.2330	.2359	.2426	.2426	.2420	.2406	.2440	.2350	.2393	.2380
.2360	.2391	.2461	.2457	.2447	.2439	.2475	.2389	.2425	.2412
.2391	.2425	.2490	.2488	.2480	.2470	.2505	.2419	.2457	.2444
.2427	.2456	.2525	.2522	.2513	.2500	.2530	.2454	.2489	.2476
.2454	.2490	.2554	.2549	.2545	.2530	.2562	.2485	.2519	.2506
.2483	.2515	.2589	.2578	.2573	.2561	.2593	.2515	.2550	.2527
.2518	.2547	.2616	.2612	.2602	.2590	.2623	.2549	.2580	.2567

No. 7905—Continued.

Load per square inch on crusher gauge one-tenth square inch area.	Total compression.											Me co rec se
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*In*
66, 000	.2638	.2562	.2544	.2574	.2635	.2635	.2630	.2618	.2651	.2570	.2606	.2
67, 000	.2665	.2591	.2570	.2603	.2669	.2661	.2651	.2644	.2675	.2602	.2633	.2
68, 000	.2691	.2619	.2602	.2629	.2698	.2689	.2683	.2673	.2700	.2627	.2661	.2
69, 000	.2720	.2645	.2627	.2654	.2721	.2716	.2706	.2699	.2726	.2654	.2687	.2
70, 000	.2740	.2669	.2654	.2680	.2747	.2743	.2734	.2725	.2752	.2678	.2712	.2
71, 000	.2762	.2695	.2675	.2709	.2770	.2761	.2754	.2749	.2775	.2705	.2736	.2
72, 000	.2789	.2721	.2705	.2733	.2798	.2789	.2776	.2769	.2801	.2730	.2761	.2
73, 000	.2813	.2745	.2727	.2757	.2819	.2810	.2805	.2792	.2820	.2754	.2784	.2
74, 000	.2835	.2768	.2746	.2776	.2831	.2833	.2825	.2819	.2843	.2777	.2805	.2
75, 000	.2859	.2792	.2770	.2804	.2863	.2856	.2850	.2840	.2868	.2801	.2830	.2
76, 000	.2880	.2814	.2793	.2825	.2888	.2879	.2865	.2861	.2888	.2823	.2852	.2
77, 000	.2902	.2837	.2820	.2846	.2911	.2902	.2890	.2884	.2910	.2845	.2875	.2
78, 000	.2921	.2855	.2833	.2867	.2930	.2924	.2916	.2905	.2930	.2870	.2895	.2
79, 000	.2944	.2879	.2855	.2887	.2950	.2941	.2934	.2938	.2951	.2889	.2917	.2
80, 000	.2965	.2901	.2878	.2910	.2970	.2964	.2954	.2946	.2969	.2910	.2937	.2
81, 000	.2984	.2920	.2900	.2927	.2992	.2980	.2975	.2964	.2988	.2927	.2956	.2
82, 000	.3005	.2940	.2921	.2949	.3009	.3000	.2997	.2986	.3008	.2946	.2976	.2
83, 000	.3024	.2961	.2940	.2968	.3028	.3020	.3013	.3002	.3027	.2966	.2995	.2
84, 000	.3042	.2979	.2957	.2988	.3047	.3038	.3032	.3024	.3045	.2984	.3014	.3
85, 000	.3060	.2997	.2974	.3009	.3066	.3057	.3050	.3040	.3065	.3003	.3032	.3
86, 000	.3076	.3019	.2998	.3026	.3084	.3075	.3065	.3057	.3080	.3022	.3050	.3
87, 000	.3092	.3034	.3017	.3041	.3103	.3090	.3085	.3075	.3097	.3040	.3067	.3
88, 000	.3111	.3051	.3033	.3057	.3120	.3110	.3102	.3090	.3115	.3059	.3085	.3
89, 000	.3126	.3068	.3052	.3074	.3135	.3125	.3117	.3109	.3130	.3074	.3101	.3
90, 000	.3142	.3086	.3065	.3095	.3154	.3144	.3134	.3124	.3145	.3092	.3118	.3
91, 000	.3157	.3103	.3080	.3108	.3167	.3158	.3151	.3140	.3157	.3109	.3133	.3
92, 000	.3174	.3121	.3099	.3124	.3182	.3173	.3165	.3155	.3176	.3128	.3150	.3
93, 000	.3188	.3133	.3115	.3140	.3200	.3189	.3181	.3170	.3191	.3140	.3165	.3
94, 000	.3204	.3150	.3129	.3155	.3213	.3204	.3199	.3186	.3209	.3155	.3180	.3
95, 000	.3220	.3166	.3143	.3171	.3229	.3219	.3214	.3204	.3223	.3169	.3196	.3
96, 000	.3234	.3178	.3160	.3186	.3244	.3231	.3228	.3217	.3238	.3185	.3210	.3
97, 000	.3248	.3195	.3175	.3200	.3256	.3245	.3240	.3229	.3250	.3199	.3224	.3
98, 000	.3260	.3209	.3190	.3215	.3270	.3261	.3255	.3242	.3262	.3210	.3237	.3
99, 000	.3272	.3224	.3204	.3231	.3284	.3274	.3270	.3256	.3276	.3229	.3252	.3
100, 000	.3286	.3237	.3218	.3243	.3300	.3289	.3283	.3271	.3289	.3244	.3266	.3

No. 7957.

Mean compression of 10 copper cylinders from lot of 5,500 received from Frankford Arsenal May 22, 1895, for Sandy Hook Proving Ground.
Copper purchased in 1893.
Table for use with crusher gauge one-tenth square inch area.
Mean dimensions of coppers: Length, ".4995; diameter, ".2518.

Load per square inch on crusher gauge one-tenth square inch area.	Total compression.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
2,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0010	.0040	.0007	.0015	.0017	.0016	.0024	.0019	.0020	.0019	.0019	.0017
9,000	.0085	.0140	.0093	.0118	.0101	.0085	.0112	.0115	.0108	.0107	.0106	.0107
10,000	.0125	.0179	.0127	.0160	.0136	.0122	.0133	.0146	.0140	.0150	.0142	.0137
11,000	.0157	.0225	.0169	.0195	.0179	.0161	.0185	.0190	.0181	.0186	.0183	.0177
12,000	.0196	.0265	.0210	.0238	.0216	.0195	.0225	.0228	.0222	.0227	.0222	.0215
13,000	.0237	.0304	.0250	.0277	.0261	.0248	.0265	.0268	.0261	.0279	.0265	.0257
14,000	.0280	.0350	.0294	.0327	.0304	.0295	.0310	.0308	.0309	.0311	.0309	.0300
15,000	.0330	.0395	.0336	.0375	.0348	.0338	.0352	.0355	.0349	.0360	.0354	.0344
16,000	.0370	.0432	.0380	.0420	.0379	.0385	.0394	.0393	.0393	.0409	.0395	.0384
17,000	.0411	.0484	.0427	.0465	.0445	.0429	.0440	.0436	.0441	.0455	.0443	.0432
18,000	.0460	.0528	.0473	.0511	.0486	.0480	.0490	.0485	.0490	.0502	.0481	.0470
19,000	.0502	.0575	.0522	.0559	.0529	.0524	.0539	.0530	.0534	.0546	.0536	.0525
20,000	.0555	.0624	.0568	.0605	.0582	.0570	.0585	.0577	.0582	.0595	.0584	.0573
21,000	.0599	.0680	.0615	.0656	.0623	.0620	.0639	.0626	.0630	.0648	.0634	.0623
22,000	.0652	.0724	.0664	.0706	.0676	.0670	.0680	.0675	.0680	.0705	.0683	.0672
23,000	.0702	.0776	.0712	.0756	.0726	.0725	.0738	.0720	.0729	.0750	.0733	.0722
24,000	.0753	.0830	.0766	.0808	.0775	.0774	.0779	.0770	.0779	.0806	.0784	.0772
25,000	.0801	.0876	.0814	.0855	.0820	.0817	.0834	.0820	.0830	.0852	.0832	.0820
26,000	.0851	.0925	.0865	.0910	.0877	.0875	.0886	.0868	.0875	.0915	.0885	.0873
27,000	.0900	.0984	.0914	.0961	.0923	.0926	.0945	.0920	.0930	.0961	.0936	.0924
28,000	.0955	.1031	.0975	.1010	.0975	.0979	.0993	.0970	.0978	.1011	.0988	.0976
29,000	.1003	.1086	.1026	.1062	.1027	.1029	.1044	.1022	.1026	.1066	.1039	.1027
30,000	.1055	.1147	.1062	.1118	.1080	.1076	.1100	.1075	.1084	.1120	.1092	.1079
31,000	.1103	.1191	.1128	.1159	.1128	.1129	.1149	.1125	.1135	.1174	.1142	.1129
32,000	.1160	.1255	.1170	.1224	.1181	.1185	.1200	.1177	.1181	.1228	.1196	.1183
33,000	.1205	.1305	.1230	.1266	.1231	.1231	.1254	.1225	.1244	.1279	.1247	.1234
34,000	.1255	.1355	.1276	.1330	.1281	.1289	.1309	.1276	.1291	.1332	.1299	.1286
35,000	.1310	.1404	.1325	.1372	.1328	.1338	.1350	.1335	.1335	.1374	.1347	.1333
36,000	.1348	.1450	.1370	.1430	.1378	.1385	.1392	.1375	.1380	.1430	.1394	.1380
37,000	.1395	.1491	.1430	.1468	.1425	.1429	.1443	.1424	.1430	.1476	.1441	.1427
38,000	.1445	.1551	.1460	.1519	.1470	.1469	.1494	.1470	.1471	.1517	.1487	.1473
39,000	.1484	.1595	.1510	.1569	.1512	.1522	.1537	.1514	.1516	.1574	.1533	.1519
40,000	.1535	.1638	.1561	.1610	.1569	.1571	.1595	.1565	.1575	.1620	.1584	.1570
41,000	.1585	.1694	.1595	.1661	.1610	.1616	.1640	.1614	.1623	.1675	.1631	.1617
42,000	.1630	.1739	.1653	.1712	.1659	.1665	.1691	.1663	.1665	.1725	.1680	.1666
43,000	.1675	.1791	.1695	.1760	.1706	.1711	.1740	.1710	.1713	.1770	.1727	.1713
44,000	.1726	.1841	.1749	.1807	.1751	.1756	.1792	.1760	.1756	.1829	.1777	.1763
45,000	.1771	.1890	.1790	.1852	.1794	.1810	.1839	.1802	.1811	.1870	.1823	.1809
46,000	.1822	.1940	.1850	.1902	.1844	.1853	.1888	.1853	.1853	.1925	.1873	.1859
47,000	.1869	.1985	.1889	.1951	.1889	.1898	.1940	.1895	.1901	.1965	.1918	.1904
48,000	.1915	.2029	.1929	.1999	.1931	.1948	.1983	.1945	.1949	.2016	.1964	.1950
49,000	.1960	.2075	.1978	.2040	.1977	.1989	.2035	.1983	.1987	.2055	.2008	.1994
50,000	.2003	.2120	.2028	.2088	.2024	.2031	.2073	.2029	.2040	.2104	.2054	.2040
51,000	.2050	.2164	.2058	.2128	.2064	.2078	.2116	.2071	.2075	.2145	.2095	.2081
52,000	.2082	.2202	.2100	.2170	.2105	.2119	.2156	.2110	.2120	.2185	.2135	.2121
53,000	.2120	.2241	.2135	.2208	.2151	.2158	.2195	.2155	.2155	.2225	.2174	.2160
54,000	.2161	.2278	.2179	.2237	.2184	.2196	.2235	.2189	.2197	.2262	.2212	.2198
55,000	.2200	.2320	.2218	.2285	.2225	.2234	.2280	.2230	.2232	.2305	.2253	.2240
56,000	.2237	.2351	.2251	.2325	.2260	.2270	.2312	.2270	.2270	.2344	.2289	.2276
57,000	.2275	.2390	.2289	.2356	.2294	.2310	.2349	.2304	.2310	.2373	.2325	.2312
58,000	.2310	.2420	.2322	.2394	.2334	.2343	.2382	.2338	.2344	.2413	.2360	.2347
59,000	.2352	.2458	.2359	.2428	.2365	.2379	.2419	.2372	.2376	.2445	.2393	.2380
60,000	.2379	.2488	.2390	.2460	.2404	.2409	.2450	.2408	.2410	.2476	.2427	.2414
61,000	.2416	.2520	.2425	.2489	.2434	.2442	.2478	.2440	.2440	.2507	.2459	.2446
62,000	.2445	.2554	.2454	.2521	.2466	.2475	.2514	.2470	.2470	.2538	.2491	.2478
63,000	.2475	.2580	.2487	.2550	.2498	.2501	.2542	.2501	.2501	.2564	.2520	.2507
64,000	.2506	.2605	.2517	.2578	.2526	.2534	.2569	.2532	.2530	.2596	.2549	.2536
65,000	.2535	.2638	.2542	.2613	.2556	.2565	.2597	.2556	.2558	.2625	.2578	.2565
66,000	.2544	.2662	.2571	.2636	.2583	.2589	.2622	.2585	.2589	.2655	.2606	.2593
67,000	.2591	.2684	.2608	.2663	.2610	.2619	.2653	.2615	.2619	.2678	.2634	.2621
68,000	.2619	.2715	.2625	.2691	.2635	.2644	.2679	.2649	.2640	.2714	.2661	.2649

No. 7957—Continued.

Load per square inch on crusher gauge one-tenth square inch area.	Total compression.											Mea cor rect sets
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch*
69,000	.2644	.2740	.2658	.2715	.2684	.2670	.2705	.2663	.2670	.2732	.2686	.267
70,000	.2666	.2764	.2680	.2734	.2685	.2695	.2732	.2690	.2695	.2755	.2710	.269
71,000	.2693	.2787	.2702	.2764	.2713	.2718	.2751	.2714	.2718	.2779	.2734	.272
72,000	.2717	.2812	.2729	.2788	.2736	.2745	.2776	.2739	.2744	.2805	.2759	.274
73,000	.2744	.2835	.2749	.2810	.2761	.2767	.2800	.2765	.2764	.2829	.2782	.277
74,000	.2765	.2856	.2771	.2834	.2784	.2792	.2825	.2785	.2792	.2845	.2805	.279
75,000	.2785	.2877	.2797	.2855	.2806	.2810	.2845	.2810	.2810	.2870	.2826	.281
76,000	.2809	.2900	.2820	.2875	.2829	.2832	.2866	.2826	.2834	.2886	.2848	.283
77,000	.2829	.2920	.2840	.2895	.2850	.2858	.2886	.2850	.2852	.2913	.2860	.285
78,000	.2851	.2941	.2858	.2916	.2870	.2878	.2908	.2872	.2875	.2934	.2890	.287
79,000	.2872	.2960	.2870	.2936	.2890	.2894	.2929	.2892	.2895	.2950	.2911	.290
80,000	.2895	.2979	.2900	.2955	.2910	.2915	.2949	.2910	.2914	.2974	.2930	.291
81,000	.2911	.3000	.2920	.2976	.2929	.2936	.2966	.2930	.2935	.2993	.2950	.293
82,000	.2930	.3018	.2938	.2996	.2948	.2952	.2984	.2949	.2955	.3011	.2968	.295
83,000	.2950	.3037	.2957	.3015	.2969	.2974	.3005	.2969	.2973	.3029	.2988	.297
84,000	.2969	.3053	.2976	.3031	.2986	.2989	.3024	.2987	.2990	.3050	.3006	.299
85,000	.2985	.3071	.2996	.3051	.3006	.3010	.3040	.3006	.3011	.3066	.3024	.301
86,000	.3004	.3089	.3014	.3066	.3024	.3026	.3057	.3025	.3029	.3081	.3042	.303
87,000	.3021	.3107	.3030	.3084	.3041	.3044	.3075	.3043	.3044	.3101	.3059	.304
88,000	.3030	.3121	.3042	.3102	.3056	.3060	.3093	.3055	.3060	.3119	.3073	.306
89,000	.3055	.3140	.3062	.3120	.3074	.3076	.3110	.3074	.3075	.3135	.3092	.308
90,000	.3072	.3155	.3080	.3135	.3090	.3094	.3127	.3092	.3094	.3150	.3109	.309
91,000	.3088	.3171	.3095	.3152	.3108	.3111	.3141	.3104	.3110	.3168	.3125	.311
92,000	.3105	.3187	.3111	.3166	.3123	.3125	.3150	.3122	.3123	.3181	.3139	.313
93,000	.3121	.3204	.3128	.3182	.3139	.3141	.3169	.3139	.3139	.3194	.3156	.314
94,000	.3135	.3318	.3142	.3196	.3155	.3156	.3183	.3150	.3155	.3209	.3170	.316
95,000	.3149	.3230	.3155	.3211	.3168	.3171	.3198	.3165	.3170	.3228	.3184	.317
96,000	.3165	.3243	.3171	.3228	.3181	.3188	.3212	.3183	.3184	.3239	.3199	.319
97,000	.3179	.3257	.3188	.3241	.3198	.3202	.3230	.3194	.3195	.3251	.3213	.320
98,000	.3194	.3272	.3201	.3255	.3211	.3215	.3243	.3209	.3210	.3265	.3227	.321
99,000	.3206	.3285	.3214	.3269	.3225	.3230	.3255	.3225	.3226	.3279	.3241	.323
100,000	.3224	.3298	.3228	.3281	.3239	.3240	.3270	.3238	.3240	.3291	.3255	.324

Chemical composition.

Per c

Copper that compressed ".1248 under initial load of 32,000 pounds per square inch....
- Cu..... 9
- Sn.....
- Zn.....
- Pb.....

Copper that compressed ".1124 under initial load of 32,000 pounds per square inch....
- Cu..... 9
- Sn.....
- Zn.....
- Pb.....

No. 7958.

Mean compression of 10 copper cylinders, from lot of 235 received from Frankford Arsenal May 25, 1895, for Springfield Armory.

Copper purchased in April, 1895.

Table for use with crusher gauge, one-thirtieth square inch area.

Mean dimensions of coppers: Length, ".4996; diameter, ".2055.

Load per square inch on crusher gauge one-thirtieth square inch area.	Total compression.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
3,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6,000	.0002	.0002	.0003	.0003	.0003	.0002	.0003	.0002	.0003	.0002	.0002	.0002
9,000	.0004	.0005	.0005	.0005	.0004	.0005	.0005	.0004	.0006	.0005	.0005	.0004
10,000	.0005	.0005	.0005	.0005	.0005	.0005	.0005	.0004	.0007	.0005	.0005	.0004
11,000	.0006	.0007	.0006	.0006	.0005	.0006	.0006	.0005	.0008	.0006	.0006	.0005
12,000	.0007	.0007	.0007	.0007	.0006	.0006	.0007	.0006	.0010	.0008	.0007	.0006
13,000	.0008	.0010	.0008	.0008	.0008	.0007	.0008	.0008	.0012	.0009	.0009	.0008
14,000	.0009	.0015	.0009	.0009	.0009	.0009	.0010	.0011	.0020	.0011	.0011	.0009
15,000	.0012	.0024	.0010	.0012	.0011	.0011	.0011	.0029	.0034	.0015	.0017	.0015
16,000	.0025	.0050	.0011	.0014	.0019	.0019	.0021	.0050	.0051	.0029	.0029	.0026
17,000	.0045	.0067	.0014	.0019	.0034	.0044	.0050	.0070	.0073	.0045	.0046	.0042
18,000	.0061	.0085	.0019	.0030	.0060	.0066	.0065	.0084	.0090	.0062	.0062	.0058
19,000	.0075	.0102	.0028	.0047	.0080	.0081	.0087	.0102	.0108	.0084	.0079	.0075
20,000	.0095	.0120	.0040	.0063	.0103	.0100	.0101	.0122	.0126	.0097	.0097	.0092
21,000	.0110	.0142	.0054	.0078	.0119	.0119	.0124	.0140	.0145	.0117	.0115	.0110
22,000	.0126	.0160	.0068	.0097	.0140	.0138	.0135	.0160	.0170	.0135	.0133	.0128
23,000	.0151	.0180	.0085	.0110	.0158	.0159	.0157	.0175	.0185	.0154	.0151	.0145
24,000	.0170	.0200	.0099	.0126	.0174	.0175	.0180	.0199	.0200	.0173	.0170	.0164
25,000	.0185	.0220	.0119	.0146	.0200	.0194	.0200	.0214	.0217	.0193	.0189	.0182
26,000	.0207	.0240	.0136	.0163	.0215	.0215	.0216	.0243	.0240	.0216	.0209	.0202
27,000	.0226	.0256	.0152	.0182	.0235	.0235	.0239	.0260	.0264	.0235	.0228	.0220
28,000	.0245	.0280	.0170	.0205	.0260	.0251	.0256	.0275	.0279	.0250	.0247	.0239
29,000	.0265	.0302	.0189	.0225	.0271	.0274	.0269	.0296	.0310	.0268	.0267	.0258
30,000	.0287	.0320	.0210	.0244	.0295	.0291	.0297	.0323	.0330	.0299	.0290	.0281
31,000	.0304	.0343	.0226	.0263	.0316	.0315	.0322	.0338	.0348	.0319	.0309	.0299
32,000	.0325	.0361	.0247	.0284	.0328	.0331	.0340	.0365	.0368	.0335	.0329	.0319
33,000	.0342	.0384	.0268	.0305	.0355	.0358	.0361	.0381	.0388	.0354	.0350	.0340
34,000	.0370	.0401	.0289	.0329	.0375	.0385	.0381	.0400	.0405	.0372	.0371	.0360
35,000	.0389	.0428	.0310	.0345	.0404	.0396	.0400	.0425	.0430	.0391	.0392	.0381
36,000	.0408	.0449	.0330	.0367	.0421	.0420	.0426	.0448	.0456	.0420	.0414	.0403
37,000	.0430	.0465	.0352	.0387	.0440	.0437	.0450	.0464	.0475	.0439	.0434	.0423
38,000	.0453	.0488	.0370	.0410	.0461	.0466	.0470	.0485	.0485	.0457	.0455	.0444
39,000	.0472	.0511	.0394	.0436	.0482	.0488	.0491	.0510	.0510	.0484	.0478	.0467
40,000	.0496	.0534	.0417	.0451	.0505	.0502	.0508	.0535	.0537	.0506	.0499	.0488
41,000	.0523	.0555	.0440	.0470	.0529	.0524	.0536	.0554	.0554	.0529	.0521	.0510
42,000	.0543	.0580	.0464	.0498	.0536	.0545	.0558	.0575	.0571	.0548	.0543	.0532
43,000	.0563	.0600	.0486	.0525	.0577	.0570	.0579	.0598	.0605	.0575	.0568	.0557
44,000	.0587	.0626	.0508	.0539	.0600	.0590	.0600	.0620	.0635	.0592	.0590	.0579
45,000	.0610	.0644	.0537	.0567	.0616	.0617	.0623	.0640	.0655	.0622	.0613	.0602
46,000	.0634	.0665	.0561	.0590	.0635	.0631	.0644	.0660	.0683	.0640	.0634	.0623
47,000	.0654	.0696	.0580	.0619	.0668	.0659	.0673	.0685	.0703	.0663	.0660	.0648
48,000	.0678	.0719	.0610	.0634	.0682	.0689	.0691	.0713	.0720	.0685	.0682	.0670
49,000	.0701	.0736	.0630	.0664	.0714	.0702	.0715	.0732	.0736	.0715	.0705	.0693
50,000	.0725	.0754	.0655	.0687	.0735	.0730	.0740	.0762	.0772	.0738	.0730	.0718
51,000	.0745	.0787	.0681	.0720	.0755	.0751	.0764	.0784	.0790	.0756	.0753	.0741
52,000	.0773	.0806	.0705	.0736	.0782	.0774	.0784	.0804	.0823	.0784	.0777	.0765
53,000	.0796	.0830	.0746	.0761	.0802	.0799	.0811	.0830	.0839	.0810	.0802	.0790
54,000	.0816	.0856	.0766	.0790	.0821	.0820	.0835	.0858	.0854	.0830	.0825	.0813
55,000	.0849	.0869	.0785	.0811	.0848	.0844	.0858	.0875	.0874	.0859	.0847	.0835
56,000	.0869	.0895	.0805	.0836	.0867	.0868	.0881	.0896	.0905	.0882	.0870	.0858
57,000	.0895	.0925	.0834	.0864	.0884	.0890	.0905	.0927	.0928	.0905	.0896	.0884
58,000	.0927	.0954	.0864	.0888	.0919	.0914	.0926	.0948	.0956	.0928	.0922	.0910
59,000	.0942	.0975	.0890	.0919	.0939	.0949	.0950	.0966	.0975	.0970	.0947	.0934
60,000	.0976	.0996	.0915	.0940	.0970	.0965	.0976	.0994	.1000	.0985	.0972	.0959
61,000	.0995	.1025	.0941	.0966	.0986	.0980	.0999	.1018	.1030	.0998	.0994	.0981
62,000	.1024	.1050	.0980	.0990	.1015	.1005	.1030	.1044	.1060	.1031	.1023	.1010
63,000	.1050	.1068	.0995	.1021	.1034	.1036	.1050	.1072	.1085	.1055	.1047	.1034
64,000	.1070	.1089	.1015	.1040	.1060	.1057	.1071	.1090	.1104	.1078	.1067	.1054
65,000	.1094	.1125	.1034	.1065	.1081	.1081	.1094	.1118	.1126	.1115	.1093	.1080
66,000	.1121	.1144	.1076	.1092	.1110	.1107	.1120	.1143	.1150	.1128	.1120	.1107
67,000	.1148	.1166	.1096	.1120	.1131	.1126	.1145	.1164	.1175	.1149	.1142	.1129
68,000	.1170	.1185	.1122	.1152	.1155	.1156	.1175	.1190	.1198	.1177	.1168	.1154

No. 7958—Continued.

Load per square inch on crusher gauge one-thirtieth square inch area.	Total compression.											Me co rec se
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*In*
69,000	.1195	.1213	.1149	.1170	.1180	.1181	.1195	.1215	.1228	.1198	.1192	.1
70,000	.1225	.1240	.1179	.1200	.1200	.1211	.1216	.1238	.1245	.1240	.1219	.1
71,000	.1245	.1260	.1202	.1239	.1230	.1230	.1250	.1265	.1270	.1256	.1245	.1
72,000	.1272	.1279	.1230	.1254	.1258	.1256	.1276	.1285	.1293	.1275	.1268	.1
73,000	.1298	.1310	.1255	.1280	.1280	.1275	.1294	.1306	.1315	.1300	.1291	.1
74,000	.1320	.1344	.1280	.1305	.1300	.1295	.1315	.1335	.1339	.1327	.1316	.1
75,000	.1344	.1355	.1305	.1327	.1326	.1325	.1342	.1356	.1363	.1350	.1339	.1
76,000	.1362	.1370	.1331	.1352	.1352	.1346	.1364	.1368	.1380	.1369	.1359	.1
77,000	.1378	.1395	.1350	.1366	.1370	.1365	.1376	.1385	.1410	.1385	.1378	.1
78,000	.1405	.1425	.1366	.1386	.1384	.1379	.1393	.1415	.1439	.1415	.1401	.1
79,000	.1430	.1445	.1389	.1415	.1414	.1400	.1421	.1444	.1451	.1436	.1425	.1
80,000	.1455	.1456	.1421	.1440	.1436	.1432	.1450	.1464	.1475	.1457	.1449	.1
81,000	.1471	.1479	.1449	.1460	.1453	.1450	.1470	.1480	.1493	.1475	.1468	.1
82,000	.1485	.1496	.1461	.1475	.1472	.1464	.1486	.1494	.1513	.1490	.1484	.1
83,000	.1507	.1516	.1486	.1495	.1484	.1485	.1510	.1519	.1540	.1525	.1507	.1
84,000	.1531	.1536	.1502	.1520	.1511	.1510	.1524	.1540	.1558	.1536	.1527	.1
85,000	.1559	.1560	.1519	.1550	.1529	.1526	.1546	.1560	.1570	.1564	.1548	.1
86,000	.1578	.1584	.1535	.1568	.1547	.1550	.1575	.1582	.1600	.1580	.1570	.1
87,000	.1597	.1607	.1565	.1588	.1574	.1570	.1591	.1605	.1625	.1606	.1593	.1
88,000	.1620	.1624	.1590	.1614	.1594	.1591	.1605	.1629	.1638	.1630	.1614	.1
89,000	.1650	.1647	.1607	.1640	.1618	.1615	.1630	.1654	.1660	.1650	.1637	.1
90,000	.1665	.1670	.1632	.1660	.1639	.1642	.1660	.1677	.1685	.1680	.1661	.1
91,000	.1679	.1694	.1655	.1676	.1662	.1655	.1680	.1695	.1702	.1695	.1679	.1
92,000	.1705	.1714	.1676	.1694	.1680	.1678	.1700	.1723	.1730	.1719	.1702	.1
93,000	.1729	.1735	.1695	.1718	.1698	.1712	.1720	.1745	.1745	.1745	.1724	.1
94,000	.1748	.1754	.1715	.1749	.1720	.1724	.1743	.1774	.1770	.1764	.1746	.1
95,000	.1775	.1786	.1744	.1771	.1746	.1740	.1770	.1787	.1791	.1785	.1769	.1
96,000	.1797	.1804	.1761	.1788	.1765	.1760	.1788	.1804	.1818	.1805	.1789	.1
97,000	.1815	.1817	.1774	.1810	.1784	.1781	.1801	.1830	.1835	.1830	.1808	.1
98,000	.1833	.1845	.1796	.1830	.1806	.1805	.1825	.1849	.1858	.1854	.1830	.1
99,000	.1855	.1858	.1827	.1858	.1828	.1825	.1847	.1873	.1876	.1880	.1853	.1
100,000	.1876	.1884	.1841	.1878	.1849	.1846	.1871	.1891	.1896	.1899	.1873	.1

EXAMINATION OF COPPER CYLINDERS RECEIVED FROM SANDY H PROVING GROUND THAT HAD BEEN PREVIOUSLY USED IN DET MINING THE POWDER PRESSURES IN 10″ GUN.

The accompanying tabulation of the examination of cylinders pressure gauges includes both the results obtained with the tes machine and a copy of the record of the coppers made during firin the proving ground.

In the present examination the cylinders were placed in the tes machine and loaded with the amount of the original initial compress While under this load the micrometer used for measuring the su quent compression of the metal was adjusted to zero reading.

The loads were then advanced and micrometer readings taken u increments of pressure of 100 pounds each, corresponding to press of 1,000 pounds per square inch referred to a pressure gauge of tenth square inch area.

In the case of the coppers of 40,000 pounds per square inch in compression the loads were increased to 50,000 pounds per square i Coppers of 32,000 pounds per square inch initial compression v loaded to 43,000 pounds for those which had not been compressed the gun beyond 37,000 pounds, while those of greater compressio the gun were loaded in the testing machine up to 48,000 pounds square inch, the object being to load the coppers in the testing mach

with such loads beyond those received in the gun as would cause decided additional flow of the metal.

With the coppers of 40,000 pounds per square inch initial compression the renewal of rapid flow occurred generally very promptly under the next higher load than that which had apparently been received by them in the gun.

The end surfaces were not strictly parallel, which may account for some of the sets taken by the coppers preceding the time of rapid flow and below the apparent powder pressure.

The very pronounced rapid flow which followed loads higher than the apparent powder pressure make it appear, so far as these tests show, that substantially no higher pressures on the coppers themselves were received while firing than indicated by their final lengths.

This statement is an inferred one, based on the assumption that pressures exceeding the elastic limit will cause permanent flow, and that the amount of permanent flow is an index of the pressure received. A modification in this statement would be necessary from what has been shown as the behavior of steel under rapidly applied stresses, in which the flow of the metal has been retarded while working under loads exceeding the elastic limit. So far as shown, however, no retardation of strains occurs in metal loaded within its elastic limit.

Inasmuch as the load of initial compression leaves the copper with an elastic limit substantially coincident with that initial load, it therefore follows that the amount of permanent flow is a correct index of the pressure, suddenly or otherwise applied, at the elastic limit of the metal and the correction for retardation of flow would be small in amount for such pressures as but slightly exceeded the elastic limit, whatever may be the influence on loads greatly exceeding the same.

For these reasons it appears justifiable to remark as above, that the powder pressures which reached the coppers were, so far as we have yet shown, substantially those shown by the firing record.

The compression given this lot of coppers in the gun has not resulted in increased rigidity under higher pressures, but they display a little less rigidity than the tabular curve of pressures calls for between the loads of 45,000 and 50,000 pounds per square inch.

Thus we make, upon examination, the following comparison:

Loads per square inch.	Compression of coppers.		Difference.
	From tabular curve of 10 coppers, June, 1893.	From average results with 18 coppers after firing.	
Pounds.	*Inch.*	*Inch.*	*Inch.*
45,000	0.	0.	.....
46,000	.0049	.0051	.0002
47,000	.0097	.0102	.0005
48,000	.0141	.0149	.0008
49,000	.0185	.0196	.0011
50,000	.0230	.0242	.0012

The coppers of 32,000 pounds per square inch initial compression behaved somewhat unlike those of the other lot.

The renewal of flow did not take place immediately upon exceeding the apparent loads which the powder pressures gave.

Thus we find, upon comparing the estimated powder pressures with

the subsequent behavior of the coppers in the testing machine, the lowing results:

Estimated powder pressure.	Testing machine load next below that causing rapid flow.	Difference.
Pounds.	*Pounds.*	*Pounds.*
36,846	38,000	1,154
40,489	43,000	2,511
a 32,000	32,000	0
42,060	45,000	2,940
41,180	44,000	2,820
36,862	38,000	1,138
39,814	42,000	2,186
40,444	43,000	2,556

a Not exceeding.

The column of differences shows the excess of pressure in the tes machine over the estimated powder pressures required to renew r flow.

The figures in this column should not be any less than here sta perhaps they should be increased by nearly 1,000 pounds each, as renewal of rapid flow occurred during the next increment of 1 pounds per square inch pressure.

This behavior is similar to that of some coppers suddenly compre with hammer blows, referred to in Report of Tests, 1888, page 754, table, pages 763 and 764.

Comparing the relative rigidity of the lot of 32,000/90 coppers a firing with the tabular curve of compressions we have—

Copper used.	Compression under loads of—			Diffe ence
	44,000 pounds.	45,000 pounds.	48,000 pounds.	
	Inch.	*Inch.*	*Inch.*	*Inch*
According to tabular curve of 10 coppers, February, 1890	0.2017		0.2201	0.01
		0.2064	.2201	.01
Showing 40,849 pounds powder pressure	.0085		.0313	.02
Showing 39,814 pounds powder pressure	.0144		.0363	.02
Showing 41,180 pounds powder pressure		.0075	.0262	.01
Showing 40,444 pounds powder pressure		.0160	.0321	.01

From this exhibit it is seen that this lot of coppers should comp ".0184 between the loads 44,000 and 48,000, inclusive, however tw the coppers after firing gave ".0228 and .0229, respectively.

And further, from the table the compression should be ".0137 45,000 to 48,000, inclusive, whereas two of the coppers used in fi gave ".0187 and ".0161, respectively.

The results of both lots, those of 40,000/93 and 32,000/90, there show less final rigidity than their respective tables call for betwee loads herein compared.

An explanation of this somewhat diminished rigidity may pos be found in the annealing effect of the temperature to which the cop were raised at the time of firing, due to the convection of heat interior mechanical work.

No. 7983.

Original dimensions of coppers, about ".5000 long by ".2500 diameter, for pressure gauge of one-tenth square inch area. Micrometer adjusted to zero under the initial load, the higher loads then applied with a testing machine.

Sandy Hook record.								Initial load.	Compression of coppers in the testing machine under loads per square inch on pressure gauge, one-tenth square inch area, of—									
Date.	Gun.	Copper.	Box.	Lengths.		Compression.	Estimated pressure.		41,000	42,000	43,000	44,000	45,000	46,000	47,000	48,000	49,000	50,000
				B. F.	A. F.													
1895.				*Inch.*	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
May 17..	Crozier 10" W. W ...	40,000/93	89	.3238	.3092	.0141	42,680	40,000	.0001	.0003	.0050	.0124	.0171	.0225	.0271	.0325	.0373	.0415
Do...	.....do	40,000/93	68	.3252	.3092	.0160	43,044	40,000	.0002	.0003	.0005	.0055	.0117	.0174	.0224	.0274	.0322	.0365
Do...	.....do	40,000/93	66	.3241	.3175	.0066	41,255	40,000	.0020	.0082	.0143	.0190	.0239	.0288	.0339	.0380	.0425	.0472
Do...	.....do	40,000/93	67	.3250	.3095	.0155	42,945	40,000	0.	.0002	.0006	.0072	.0140	.0191	.0240	.0293	.0335	.0385
May 16..	.....do	40,000/93	20	.3238	.3175	.0063	41,200	40,000	.0035	.0099	.0153	.0200	.0256	.0298	.0344	.0397	.0437	.0487
May 17..	.....do	40,000/93	87	.3240	.3065	.0175	43,360	40,000	.0001	.0002	.0004	.0015	.0089	.0148	.0205	.0250	.0299	.0345
Do...	.....do	40,000/93	88	.3240	.3028	.0212	44,109	40,000	.0001	.0002	.0003	.0005	.0046	.0117	.0172	.0224	.0269	.0319
Do...	.....do	40,000/93	86	.3248	.3115	.0133	42,527	40,000	.0002	.0006	.0049	.0117	.0169	.0224	.0273	.0318	.0362	.0411
Do...	.....do	40,000/93	70	.3345	.3075	.0170	43,260	40,000	.0001	.0003	.0016	.0086	.0141	.0186	.0240	.0286	.0335	.0375
May 16..	.....do	40,000/93	21	.3236	.3185	.0051	40,982	40,000	.0050	.0114	.0173	.0224	.0267	.0314	.0367	.0413	.0456	.0496
Do...	.....do	40,000/93	16	.3230	.3125	.0105	41,983	40,000	.0001	.0015	.0096	.0150	.0205	.0252	.0304	.0346	.0399	.0438
Do...	.....do	40,000/93	19	.3240	.3095	.0145	42,760	40,000	.0001	.0002	.0007	.0075	.0140	.0189	.0240	.0291	.0339	.0387
Do...	.....do	40,000/93	18	.3240	.3130	.0110	42,077	40,000	.0001	.0006	.0077	.0138	.0190	.0236	.0286	.0335	.0381	.0427
May 17..	.....do	40,000/93	90	.3231	.3092	.0139	42,640	40,000	.0001	.0005	.0039	.0114	.0169	.0220	.0269	.0316	.0365	.0411
Do...	.....do	40,000/93	85	.3247	.3067	.0180	43,455	40,000	0.	.0002	.0005	.0050	.0124	.0179	.0225	.0274	.0323	.0373
Do...	.....do	40,000/93	65	.3240	.3210	.0030	40,620	40,000	.0055	.0105	.0153	.0208	.0255	.0301	.0345	.0390	.0430	.0482
Do...	.....do	40,000/93	17	.3230	.3130	.0100	41,900	40,000	.0007	.0060	.0118	.0176	.0220	.0269	.0321	.0366	.0415	.0457
Do...	.....do	40,000/93	69	.3248	.3085	.0163	43,111	40,000	.0001	.0003	.0007	.0058	.0120	.0176	.0230	.0270	.0320	.0369
Total compression from original initial compression.....													.0298	.0349	.0400	.0447	.0494	.0540

No. 7983—Continued.

Sandy Hook record.								Initial load.	Compression of coppers in the testing machine under loads per square inch on pressure gauge, one-tenth square inch area, of—															
Date.	Gun.	Copper.	Box.	Lengths.		Compression.	Estimated pressure.		33,000	34,000	35,000	36,000	37,000	38,000	39,000	40,000	41,000	42,000	43,000	44,000	45,000	46,000	47,000	48,000
				B. F.	A. F.																			
1895.				*Inch.*	*Inch.*	*Inch.*	*Lbs.*	*Lbs.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
May 13..	Crozier 10″ W. W.	32,000/90	57	.3654	.3385	.0289	36,846	32,000	0.	.0001	.0002	.0004	.0005	.0013	.0096	.0169	.0225	.0282	.0336	.....	.....	.....	.....	.....
Do...	.....do	32,000/90	64	.3615	.3148	.0467	40,489	32,000	.0001	.0001	.0002	.0003	.0003	.0004	.0005	.0005	.0006	.0008	.0013	.0085	.0155	.0221	.0260	.0313
Do...	.....do	32,000/90	63	.3615	.3615	0.	†	32,000	a. 0006 b. 0020	.0082	.0129	.0182	.0240	.0294	.0346	.0399	.0456	.0505	.0556	.....	.....	.....	.....	.....
Do...	.....do	32,000/90	62	.3620	.3070	.0550	42,060	32,000	0.	.0001	.0001	.0001	.0002	.0002	.0003	.0004	.0005	.0006	.0006	.0008	.0015	.0071	.0154	.0199
Do...	.....do	32,000/90	60	.3610	.3106	.0504	41,180	32,000	0.	0.	.0001	.0001	.0001	.0001	.0003	.0003	.0004	.0005	.0006	.0011	.0075	.0149	.0206	.0262
Do...	.....do	32,000/90	58	.3660	.3390	.0270	36,862	32,000	0.	0.	.0001	.0001	.0002	.0005	.0059	.0143	.0200	.0257	.0320	.....	.....	.....	.....	.....
Do...	.....do	32,000/90	59	.3610	.3180	.0430	39,814	32,000	.0001	.0001	.0002	.0003	.0004	.0004	.0005	.0006	.0008	.0011	.0068	.0144	.0208	.0260	.0306	.0363
Do...	.....do	32,000/90	61	.3625	.3160	.0465	40,444	32,000	.0001	.0001	.0001	.0002	.0003	.0004	.0005	.0006	.0007	.0009	.0015	.0090	.0160	.0210	.0269	.0321

a Immediate compression.

b After sustaining load 15 seconds.

TENSION TESTS OF TOBIN BRONZE.

Specimens turned down from rods $\frac{3}{8}$'' and $\frac{7}{16}$'' diameter.

No. of test.	Diameter.	Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 1 inch.		Area at fracture.	Contraction of area.	Appearance of fracture.
			Total.	Per square inch.	Total.	Per square inch.	Inches.	Per cent.			
	Inch.	*Sq. in.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			*In. Sq. in.*	*Per ct.*	
7314	.264	.055	3,590	65,270	4,030	73,270	.20	20	Diam., .18=.025	54.5	Light uniform yellow color.
7315	.261	.054	3,710	68,700	4,035	74,720	.20	20	Diam., .18=.025	53.7	Do.

Chemical composition..

	Per cent.
Cu	63.14
Sn	0.21
Zn	35.81
Pb	0.51

HELICAL SPRINGS.

COMPRESSION OF HELICAL SPRINGS FOR 7" MORTAR CARRIAGES.

Dimensions:

Diameter of wire, ".64.

Exterior diameter of coil, 3".97.

Distance between adjacent coils of same spring, ".60±.

Weight of one spring 5 pounds 15¼ ounces and weight of another 5 pounds 14¾ ounces.

No. of test.	Initial height of spring.	Loads when heights of springs are—					Final height of spring.
		6".	4½".	Closed down.		6".	
				Load.	Height.		
	Inches.	*Pounds.*	*Pounds.*	*Pounds.*	*Inches.*	*Pounds.*	*Inches.*
7288	7.25	957	2,196	2,995	4.16	891	7.20
7289	7.38	1,092	2,234	3,130	4.14	920	7.34
7290	7.16	822	2,047	3,110	4.07	652	7.10
7291	7.23	953	2,190	3,090	4.08	768	7.19
7292	7.37	1,112	2,284	3,280	4.15	958	7.33
7293	7.10	940	2,185	3,090	4.10	816	7.07
7294	7.17	916	2,116	2,996	4.08	772	7.10
7295	6.91	893	2,187	3,100	4.10	744	6.88
7296	7.07	983	2,188	3,050	4.11	833	7.02
7297	6.94	900	2,166	3,060	4.08	752	6.92

Nos. 7288 and 7292 closed down and remained there 17 hours. Upon releasing the springs returned to a mean height of 7".24.

No. of test.	Initial height of spring.	Loads when height of springs are—					Final height of spring.
		6".	4½".	Closed down.		6".	
				Load.	Height.		
	Inches.	*Pounds.*	*Pounds.*	*Pounds.*	*Inches.*	*Pounds.*	*Inches.*
7288 *a*	7.20	952	2,194	3,000	4.15	874	7.19
7292 *a*	7.28	1,065	2,249	3,100	4.14	962	7.28
7297 *a*	6.92	* 850	.....	.....	.....	.....	.....

*Loaded 5 times, compressing the spring each time to a height of 4".25; finally the spring at a height of 9" sustained 781 pounds, the final height unloaded being 6".91.

Springs consist of nest of three concentric springs each. Springs branded "A. French Spring Co. ☞ G. E. 4 95."

DESCRIPTION OF SPRINGS.

Spring.	Weight.		Outside coil.			Middle coil.		Inside coil.	
	Pounds.	Ounces.	Exterior diameter of coil.	Diameter of wire.	Interior diameter of coil.	Diameter of wire.	Interior diameter of coil.	Diameter of wire.	Interior diameter of coil.
			Inches.	*Inches.*	*Inches.*	*Inch.*	*Inches.*	*Inch.*	*Inches.*
No. 1	24	3	6.06	1.13	3.80	.76	2.18	.35	1.25
No. 2	24	1½	6.04	1.13	3.80	.75	2.19	.35	1.25

COMPRESSION TESTS.

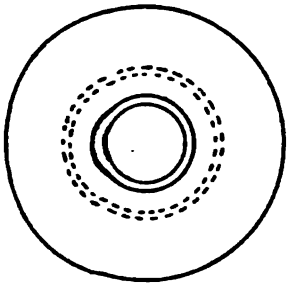
Applied loads.	No. 7901.		No. 7902.	
	Spring No. 1.		Spring No. 2.	
	Height.	Compression.	Height.	Compression.
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
0	6.21	0.	6.19	0.
500	6.09	.12	6.10	.09
1,000	6.01	.20	6.03	.16
2,000	5.90	.31	5.95	.24
3,000	5.81	.40	5.87	.32
5,000	5.66	.55	5.70	.49
10,000	5.27	.94	5.32	.87
15,000	4.88	1.43	4.94	1.25
10,000	5.21	1.00	5.27	.92
5,000	5.60	.61	5.64	.55
1,000	5.98	.23	6.02	.17

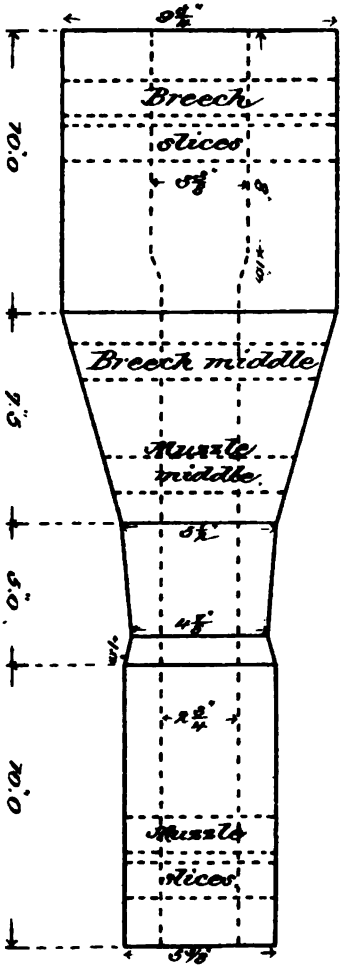
INTERNAL STRAINS

IN

EXPERIMENTAL STEEL FORGING.

Experimental forging for internal strains.

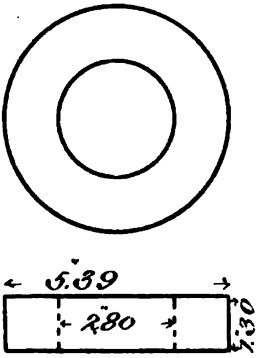




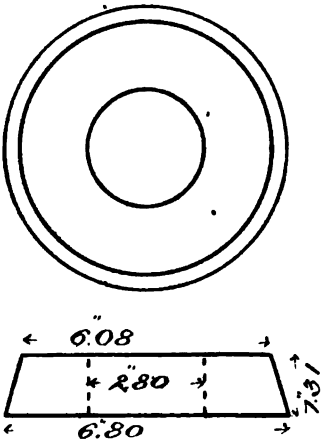
THE HORNE PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

Slices as received.

Muzzle slice.



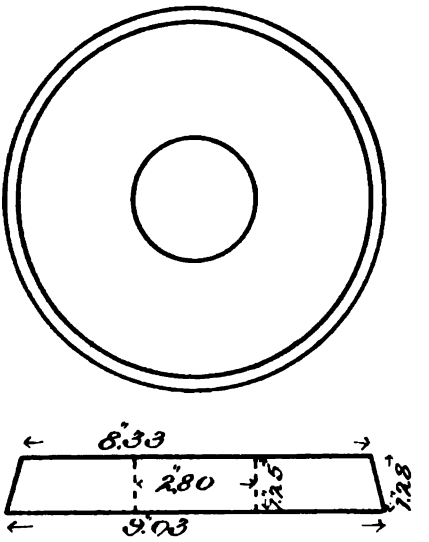
Muzzle middle slice.



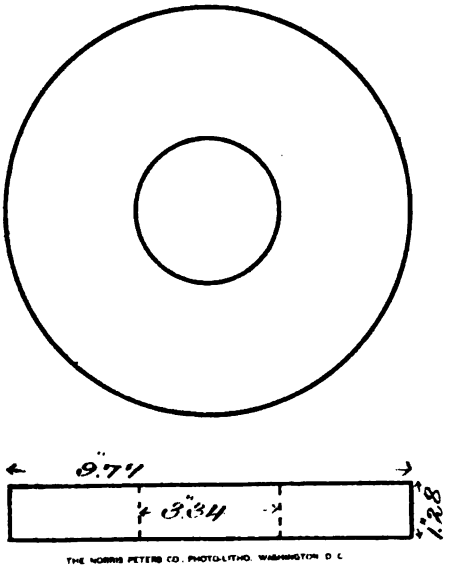
THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

Slices as received.

Breech middle slice.



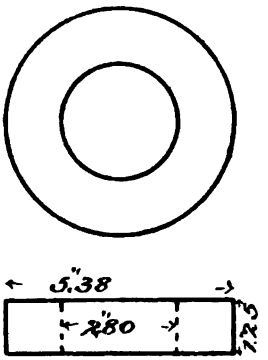
Breech slice.



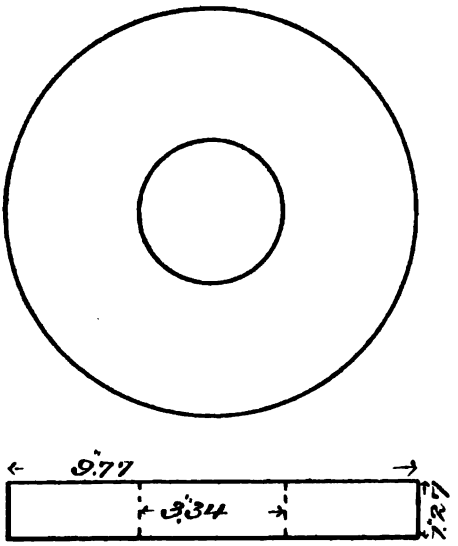
THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

Slices as received.

Muzzle slice, annealed.



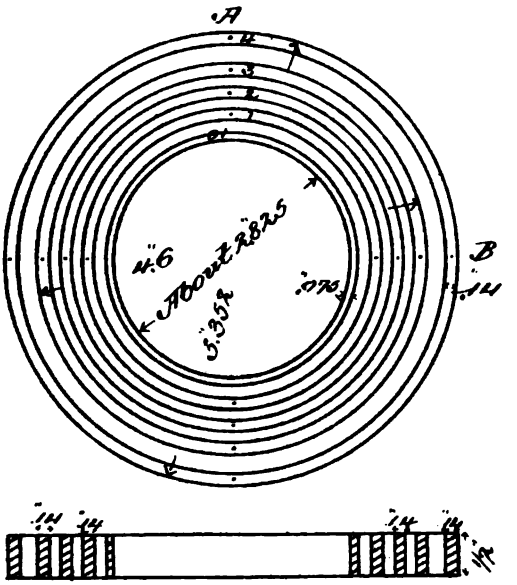
Breech slice, annealed.



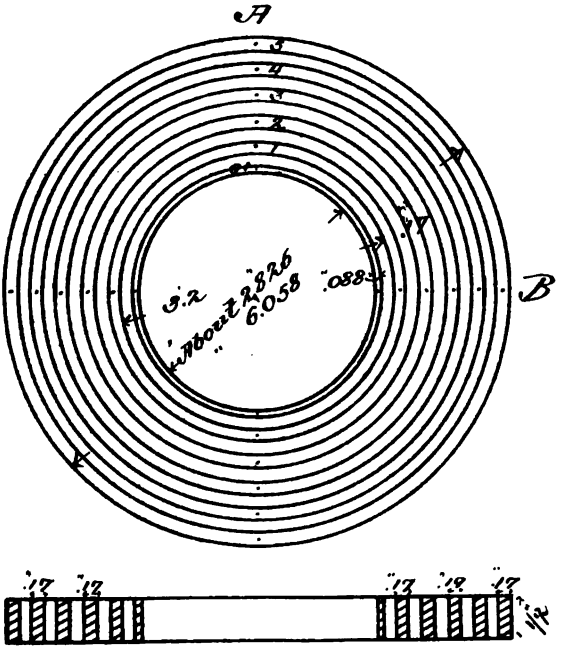
THE NORRIS PETERS CO. PHOTO-LITHO. WASHINGTON D. C.

Finished dimensions.

Muzzle slice.

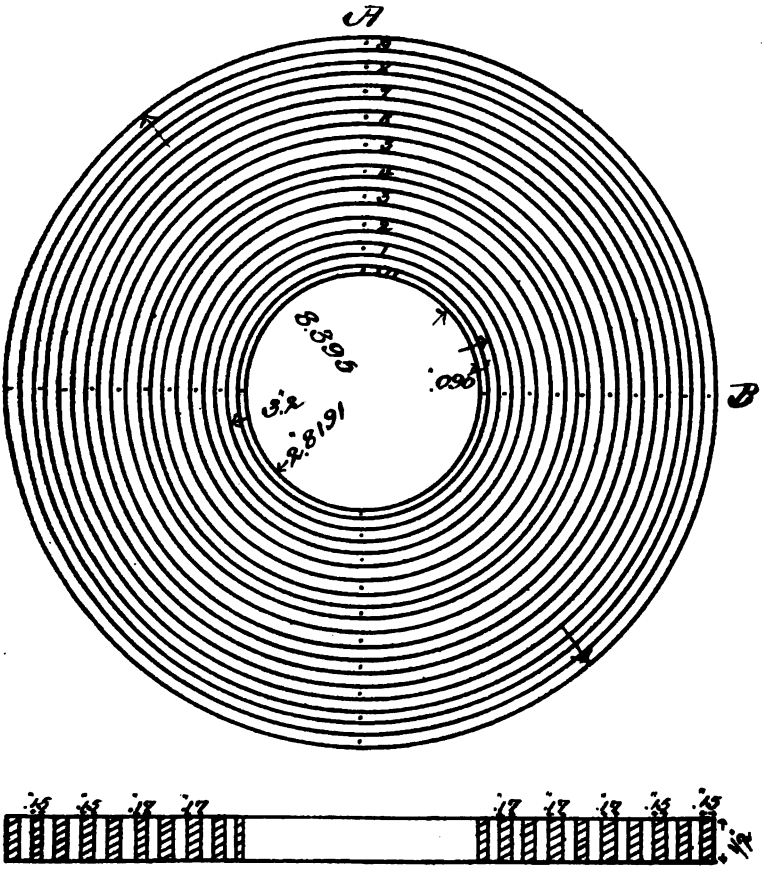


Muzzle middle slice.



Finished dimensions.

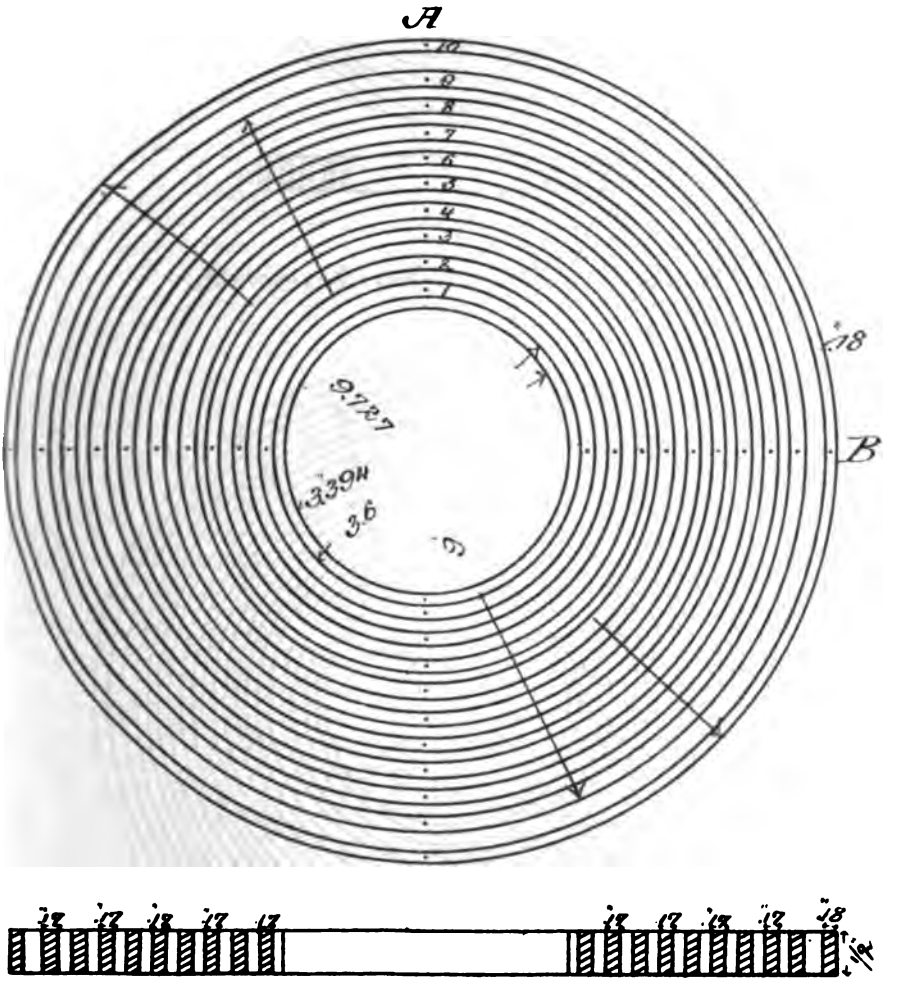
Breech middle slice.



THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

Finished dimensions.

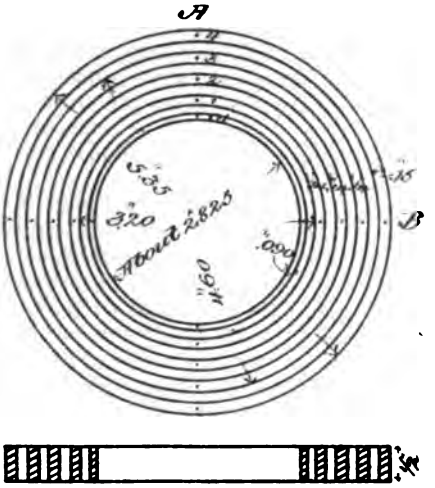
Breech slice.



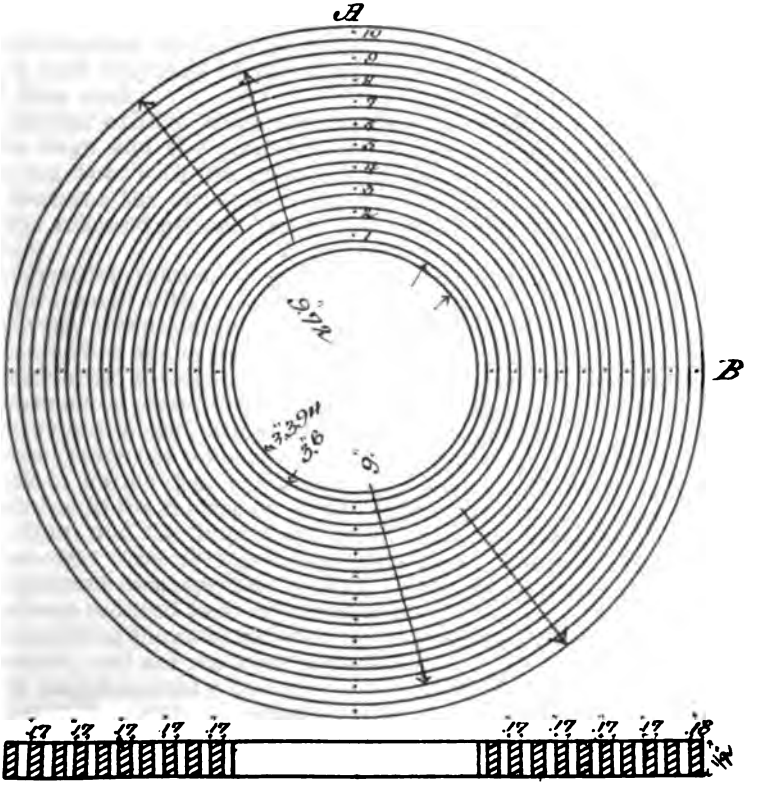
THE HORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

Finished dimensions.

Muzzle slice, annealed.



Breech slice, annealed.



THE HORRIS PETERS CO., PHOTO-LITHO. WASHINGTON, D. C.

INTERNAL STRAINS IN EXPERIMENTAL STEEL FORGING.

The internal strains here investigated were introduced in the forging by the method of heating the forging and cooling the same from the bore.

The slices received for testing were cut at middle of their length into two parts, one part of each being used in the present experiments; the other pieces are held in reserve.

The finished slices, from whence the rings were taken, were one-half inch long each.

Before entering upon the operations of facing up the slices and detaching the rings, some preliminary observations were made upon the tendency of the lathe tool to introduce internal strains while the machine work was in progress.

The tendency commonly is to introduce strains of compression when metal is turned off, but the maximum effect is reached only when a heavy feed and cut are both taken.

While there is a probability that some strains were unavoidably introduced by the facing and cutting-off tool, it is believed they were of small magnitude, insufficient to materially modify the observed results.

After facing off, the surface diameters were established and drilled and countersunk holes used to define the extremities of the diameters on each ring into which the slices were subsequently cut.

Two diameters were laid off and measured at right angles to each other.

The diameters were first measured when the slices were intact, and again at each stage as the rings were successively detached. The order of removal of the rings is shown by the arrangement of the results.

Part 1 of these experiments contains drawings giving the dimensions of the experimental forging, the dimensions of the slices as received for testing, and drawings of the slices showing the rings which were detached from each.

In the tabular exhibit which next follows are given the mean diameters of the rings and the strains which existed at different phases of the slices, together with the stresses corresponding thereto.

Part 2 contains the measured diameters on lines A and B and the total strains released at each stage, referred to the original diameters of the rings.

The progressive release of strains as the rings were successively detached proceeded with remarkable regularity.

An apparent exception occurred, however, in the case of ring No. 3 of the muzzle slice at the time of removal of ring 01.

The behavior of adjacent rings throws doubt upon the reliability of the measurements pertaining to this ring, although the full details of the micrometer observations otherwise look consistent.

In the final stages of some of the slices and of some of the detached rings a lack of harmony of action appeared which may in some degree be attributable to the release of strains being greater on one diameter than the other, and the improbability of the mean changes of the observed diameters correctly representing the mean changes in the rings.

These apparent eccentricities pertain to the slices and rings when they have been reduced to small dimensions.

After completing the main series of tests some supplementary features were examined, and are reported in part 3.

The first supplementary test was made with ring No. 1 from the breech slice, which was subjected to augmented compression for the purpose of ascertaining whether the elastic limit of the ring coincided with or exceeded the initial compression found in the slice.

The presence of scale on the surfaces of the rings shrunk togeth to produce augmented compression, caused a somewhat higher co pression than intended.

The final diameters of the detached ring showed a permanent set ".0067". The recovery of the ring from its assembled state was ".01 which corresponds to 93,000 pounds per square inch compression.

Considering the amount of the permanent set given, and the recov displayed, it is conjectured that the compressive elastic limit of this ri was somewhat higher than the amount of initial compression which isted in the slice, or at least that in passing from a stress of 71,400 93,000 pounds per square inch there was not a large set given the met

Tensile stress was applied to ring 1 from the breech middle slice for t purpose of ascertaining the tensile elastic limit of this ring, which in t slice had been subjected to 78,200 pounds per square inch compressi

A tapered mandrel was driven through a bronze bushing within t experimental ring.

The loads applied to the mandrel were weighed. This force var over wide limits owing to the different lubricants used.

There was an early set developed, which for a time did not rapi increase. The restoration in diameter at the time when the sets beg to increase rapidly was ".0062, corresponding to a stress of 52,400 pou per square inch, which can be taken as approximately representing tensile elastic limit of this ring.

Annealing tests were made with rings Nos. 3 and 4 from the annea breech slice.

The primary object of these tests was to ascertain whether the ri would display any movement which could be regarded as the releas internal strains introduced by the lathe tool.

Temperatures below 700° F. caused no appreciable change in dia eters.

After exposure to a red heat estimated at 1,050° F. there wa decided permanent expansion of ring No. 3, and ring No. 4 changed shape somewhat.

The interpretation of these changes is obscure and will require ad tional tests to elucidate. The points involved seem to be, which stress tensile or compressive, are first released by elevation of temperatu and how the relative intensity of the two stresses modify the results

Finally rings Nos. 2 and 3 from breech and breech middle slices w shrunk together after having been bored to suitable diameters a annealed at different temperatures.

These tests were for the purpose of ascertaining in which direct relief from shrinkage strains would occur.

When assembled the outer ring was heated to about 500° F.

After assembling, the inner ring appeared to be under compress stress of much greater intensity than the tensile stress of the outer ri

Annealing at 700° F. produced no marked change. After heating t dull red the rings were decidedly enlarged, and so far as this behavior c stitutes evidence, tensile stress was dissipated, the compressive str being the more permanent, although of greater intensity at the beginni

It is inferred that such was the probable effect.

After annealing at a red heat the strains were practically elimina in both rings, and they could be forced apart with the hands.

The rings were heated in a sand bath, when they were raised t light blue color; subsequent heatings were done over an open fire.

More refined tests of this nature would require special preparati for insuring uniform heating of the rings to prevent local progressi in the release of the strains.

INTERNAL STRAINS

IN

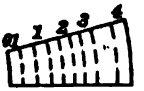
EXPERIMENTAL STEEL FORGING.

PART 1.

MUZZLE SLICE.

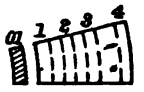
STATE OF INTERNAL STRAINS AND STRESSES AT DIFFERENT PHASES OF THE SLICE.

SLICE INTACT.



Rings.		Present mean diameter.	Strains.		Stresses per square inch.	
			Tension.	Compression.	Tension.	Compression.
		Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
Bore	01....	2.8248[5]	.....	.0051[5]	.....	54,690
	1....	3.3395[5]	.....	.0037[5]	.....	33,690
	2....	3.8977[5]	.....	.0007[5]	.....	5,770
	3....	4.4559[5]	.0016[5]	.....	11,100	.....
	4....	5.2044[5]	.0054[5]	.....	31,400	.....
Exterior	4....	5.3486[5]	.0058[5]	.....	32,800	.....

RING 01 DETACHED. RINGS 1 TO 4 IN THE SLICE.



Rings.		Present mean diameter.	Strains.		Stresses per square inch.	
			Tension.	Compression.	Tension.	Compression.
		Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
Bore	01....	2.8300	.....	.....	.....	.....
	1....	3.3382[5]	.....	.0050[5]	.....	45,400
	2....	3.8963[5]	.....	.0021[5]	.....	16,590
	3....	4.4566[5]	.0023[5]	.....	15,800	.....
	4....	5.2035	.0045	.....	25,900	.....
Exterior	4....	5.3476	.0048	.....	26,900	.....

RINGS 01 AND 4 DETACHED. RINGS 1, 2, AND 3 IN THE SLICE.

Rings.		Present mean diameter.	Strains.		Stresses per square inch.	
			Tension.	Compression.	Tension.	Compression.
		Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1		3.3404	.....	.0029	.....	26,000
2		3.8982[5]	.....	.0002[5]	.....	1,900
3		4.4585[5]	.0042[5]	.....	28,600	.....

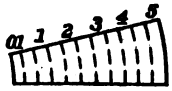
RINGS 01, 1, AND 4 DETACHED. RINGS 2 AND 3 IN THE SLICE.

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
2	3.8962	.0020		13,800	
3	4.4563[5]		.0023		17,700

MUZZLE MIDDLE SLICE.

STATE OF INTERNAL STRAINS AND STRESSES AT DIFFEREN PHASES OF THE SLICE.

SLICE INTACT.



Rings.		Present mean diameter.	Strains.		Stresses per square inch.	
			Tension.	Compression.	Tension.	Compression.
		Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
Bore	01	2.8326[5]		.0052[7]		55,800
	1	3.3741		.0054		48,000
	2	4.0199[5]		.0006[5]		4,850
	3	4.6566	.0042[5]		27,400	
	4	5.2563	.0066		37,600	
	5	5.8901	.0056		28,500	
Exterior	5	6.0576	.0054[5]		27,000	

RING 01 DETACHED. RINGS 1, 2, 3, 4, AND 5 IN THE SLICE. INTERIOR DIAME OF SLICE, 3″.2.

Rings.		Present mean diameter.	Strains.		Stresses per square inch.	
			Tension.	Compression.	Tension.	Compression.
		Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
Interior	1	3.2017[5]		.0069[7]		65,300
	1	3.3727[5]		.0067[5]		60,000
	2	4.0188		.0018		13,400
	3	4.6553	.0029[5]		19,000	
	4	5.2550[5]	.0053[5]		30,500	
	5	5.8889	.0044[5]		22,700	
Exterior	5	6.0566	.0044[5]		22,000	

RINGS 01 AND 1 DETACHED. RINGS 2, 3, 4, AND 5 IN THE SLICE.

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
2	4.0157	.....	.0049	.....	36,600
3	4.6529	.0005[5]	.....	3,500	.....
4	5.2525	.0023	.....	16,000	.....
5	5.8866[5]	.0021[5]	.....	10,900	.....

RINGS 01, 1, AND 2 DETACHED. RINGS 3, 4, AND 5 IN THE SLICE.

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
3	4.6506[5]	.....	.0017	.....	10,900
4	5.2506[5]	.0009[5]	.....	5,400	.....
5	5.8850[5]	.0005[5]	.....	2,800	.....

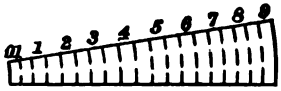
RINGS 01, 1, 2, AND 3 DETACHED. RINGS 4 AND 5 IN THE SLICE.

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
4	5.2501	.0004	.....	2,300	.....
5	5.8842[5]	.....	.0002[5]	.....	1,200

BREECH MIDDLE SLICE.

STATE OF INTERNAL STRAINS AND STRESSES AT DIFFE PHASES OF THE SLICE.

SLICE INTACT.

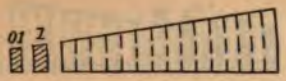


Rings.		Present mean diameter.	Strains.		Stresses per square inch.	
			Tension.	Compression.	Tension.	Compression.
		Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
Bore	01....	2.8192[5]	.....	.0058	.....	61,700
	1....	3.3781	.....	.0069	.....	61,200
	2....	4.0107[5]	.....	.0045[5]	.....	34,000
	3....	4.6459[5]	.....	.0003[5]	.....	2,300
	4....	5.2682[5]	.0021[5]	.....	12,200	.....
	5....	5.9092[5]	.0043[5]	.....	22,100	.....
	6....	6.5117[5]	.0070[5]	.....	32,500	.....
	7....	7.0937[5]	.0089[5]	.....	37,400	.....
	8....	7.6628	.0095[5]	.....	37,400	.....
	9....	8.2539	.0089[5]	.....	32,500	.....
Exterior	9....	8.3943	.0091	.....	32,500	.....

RING 01 DETACHED. RINGS 1 TO 9 IN THE SLICE.

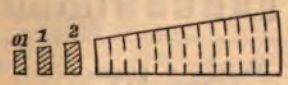
Rings.		Present mean diameter.	Strains.		Stresses per square inch.	
			Tension.	Compression.	Tension.	Compression.
		Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
Interior	1....	3.2011	.....	.0083[5]	.....	78,200
	1....	3.3765[5]	.....	.0084[5]	.....	75,000
	2....	4.0095[5]	.....	.0057[5]	.....	43,000
	3....	4.6446[5]	.....	.0016[5]	.....	10,600
	4....	5.2674	.0013	.....	7,490	.....
	5....	5.9085[5]	.0036[5]	.....	18,500	.....
	6....	6.5108[5]	.0061[5]	.....	28,300	.....
	7....	7.0930	.0081	.....	34,200	.....
	8....	7.6623	.0090[5]	.....	35,400	.....
	9....	8.2534	.0084[5]	.....	30,700	.....
Exterior	9....	8.3939[5]	.0087[5]	.....	31,300	.....

1 AND 1 DETACHED. RINGS 2 TO 9 IN THE SLICE.



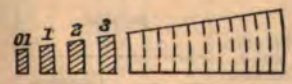
	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
.....	4.0069	.....	.0084	.....	62,800
.....	4.6425	.....	.0038	.....	24,500
.....	5.2652	.....	.0009	.....	5,100
.....	5.9064	.0015	.....	7,600	.....
.....	6.5090	.0043	.....	19,800	.....
.....	7.0911	.0062	.....	27,100	.....
.....	7.6605	.0072⅝	.....	28,400	.....
.....	8.2516	.0066⅝	.....	24,200	.....

1, AND 2 DETACHED. RINGS 3 TO 9 IN THE SLICE.



	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
.....	4.6399⅝	.....	.0063⅝	.....	41,000
.....	5.2630	.....	.0031	.....	17,600
.....	5.9042⅝	.....	.0006⅝	.....	3,300
.....	6.5070	.0023	.....	10,600	.....
.....	7.0892⅝	.0043⅝	.....	18,400	.....
.....	7.6587	.0054⅝	.....	21,300	.....
.....	8.2500	.0051	.....	18,500	.....

1, 2, AND 3 DETACHED. RINGS 4 TO 9 IN THE SLICE.

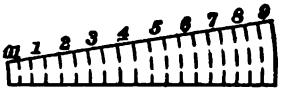


	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
.....	5.2609⅝	.....	.0051⅝	.....	29,300
.....	5.9024	.....	.0025	.....	12,700
.....	6.5052⅝	.0005⅝	.....	2,500	.....
.....	7.0876⅝	.0027⅝	.....	11,600	.....
.....	7.6571	.0038⅝	.....	15,100	.....
.....	8.2482	.0032⅝	.....	11,800	.....

BREECH MIDDLE SLICE.

STATE OF INTERNAL STRAINS AND STRESSES AT DIFFERENT PHASES OF THE SLICE.

SLICE INTACT.

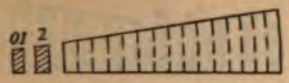


Rings.		Present mean diameter.	Strains.		Stresses per square inch.	
			Tension.	Compression.	Tension.	Compression.
		Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
Bore	01....	2.8192[5]	.....	.0058	.....	61,700
	1....	3.3781	.....	.0060	.....	61,200
	2....	4.0107[5]	.....	.0045[5]	.....	34,000
	3....	4.6459[5]	.....	.0003[5]	.....	2,300
	4....	5.2082[5]	.0021[5]	.....	12,200	.....
	5....	5.9092[5]	.0043[5]	.....	22,100	.....
	6....	6.5117[5]	.0070[5]	.....	32,500	.....
	7....	7.0937[5]	.0088[5]	.....	37,400	.....
	8....	7.6628	.0095[5]	.....	37,400	.....
	9....	8.2539	.0089[5]	.....	32,500	.....
Exterior	9....	8.3943	.0091	.....	32,500	.....

RING 01 DETACHED. RINGS 1 TO 9 IN THE SLICE.

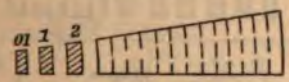
Rings.		Present mean diameter.	Strains.		Stresses per square inch.	
			Tension.	Compression.	Tension.	Compression.
		Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
Interior	1....	3.2011	.....	.0083[5]	.....	78,200
	1....	3.3765[5]	.....	.0084[5]	.....	75,000
	2....	4.0095[5]	.....	.0057[5]	.....	43,000
	3....	4.6446[5]	.....	.0016[5]	.....	10,600
	4....	5.2674	.0013	.....	7,490	.....
	5....	5.9085[5]	.0036[5]	.....	18,500	.....
	6....	6.5108[5]	.0061[5]	.....	28,300	.....
	7....	7.0930	.0081	.....	34,200	.....
	8....	7.6623	.0090[5]	.....	35,400	.....
	9....	8.2534	.0084[5]	.....	30,700	.....
Exterior	9....	8.3939[5]	.0087[5]	.....	31,300	.....

RINGS 01 AND 1 DETACHED. RINGS 2 TO 9 IN THE SLICE.



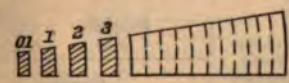
Rings.	Present mean diameter.	Strains.		Stress per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
2	4.0069	.....	.0084	.....	62,800
3	4.6425	.....	.0038	.....	24,500
4	5.2652	.....	.0009	.....	5,100
5	5.9064	.0015	.....	7,600	.....
6	6.5090	.0043	.....	19,800	.....
7	7.0911	.0062	.....	27,100	.....
8	7.6605	.0072⁵	.....	28,400	.....
9	8.2516	.0066⁸	.....	24,200	.....

RINGS 01, 1, AND 2 DETACHED. RINGS 3 TO 9 IN THE SLICE.



Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
3	4.6399⁵	.....	.0063⁵	.....	41,000
4	5.2630	.....	.0031	.....	17,600
5	5.9042⁵	.....	.0006⁵	.....	3,300
6	6.5070	.0023	.....	10,600	.....
7	7.0892⁵	.0043⁵	.....	18,400	.....
8	7.6587	.0054⁵	.....	21,300	.....
9	8.2500	.0051	.....	18,500	.....

RINGS 01, 1, 2, AND 3 DETACHED. RINGS 4 TO 9 IN THE SLICE.



Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
4	5.2609⁵	.....	.0051⁵	.....	29,300
5	5.9024	.....	.0025	.....	12,700
6	6.5052⁵	.0005⁵	.....	2,500	.....
7	7.0876⁵	.0027⁵	.....	11,600	.....
8	7.6571	.0038⁵	.....	15,100	.....
9	8.2482	.0032⁵	.....	11,800	.....

RINGS 01, 1, 2, 3, AND 4 DETACHED. RINGS 5 TO 9 IN THE SLICE.

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
5	5.9006[5]	.....	.0042[5]	.....	21,600
6	6.5036	.....	.0011	.....	5,100
7	7.0860[5]	.0011[5]	.....	4,900	.....
8	7.6555	.0022[5]	.....	8,800	.....
9	8.2468	.0018[5]	.....	6,700	.....

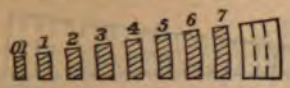
RINGS 01 TO 5 DETACHED. RINGS 6 TO 9 IN THE SLICE.

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
6	6.5023	.....	.0023[5]	.....	10,800
7	7.0847	.....	.0002	.....	900
8	7.6543	.0010[5]	.....	4,100	.....
9	8.2456	.0006[5]	.....	2,400	.....

RINGS 01 TO 6 DETACHED. RINGS 7, 8, AND 9 IN THE SLICE.

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
7	7.0838	.....	.0011	.....	4,600
8	7.6529	.....	.0003[5]	.....	1,400
9	8.2447	.....	.0002[5]	.....	900

RINGS 01 TO 7 DETACHED. RINGS 8 AND 9 IN THE SLICE.

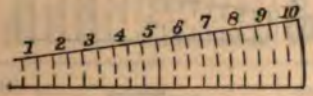


Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
8	7.6529[5]	.....	.0003	.....	1,200
9	8.2444	.....	.0005[5]	.....	2,000

BREECH SLICE.

STATE OF INTERNAL STRAINS AND STRESSES AT DIFFERENT PHASES OF THE SLICE.

SLICE INTACT.



Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	3.8045	.....	.0081[5]	.....	64,300
2	4.4029	.....	.0077	.....	52,500
3	5.0453	.....	.0043	.....	25,000
4	5.6981	.....	0.	.....	0
5	6.3171[5]	.0035[5]	.....	15,900	.....
6	6.9453[5]	.0060[5]	.....	26,100	.....
7	7.5783	.0087[5]	.....	34,600	.....
8	8.2157[5]	.0101	.....	36,900	.....
9	8.8194[5]	.0113	.....	38,400	.....
10	9.5412[5]	.0139[5]	.....	43,900	.....
10	9.7256[5]	.0126	.....	38,900	.....

BORE OF SLICE TURNED OUT TO 3″.6 DIAMETER.

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	3.8036		.0096[5]		71,400
2	4.4022[5]		.0083[5]		56,900
3	5.0445[5]		.0050[5]		30,000
4	5.6976[5]		.0004[5]		2,300
5	6.3168	.0030		14,200	
6	6.9448[5]	.0055[5]		21,000	
7	7.5778[5]	.0083		32,000	
8	8.2153[5]	.0097		35,400	
9	8.8189[5]	.0108		36,700	
10	9.5409[5]	.0136[5]		42,900	

RING 1 DETACHED. RINGS 2 TO 10 IN THE SLICE.

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
2	4.3996[5]		.0109[5]		74,600
3	5.0422[5]		.0073[5]		43,700
4	5.6955[5]		.0027[5]		13,400
5	6.3147	.0009		4,300	
6	6.9430	.0037		16,000	
7	7.5761[5]	.0066		26,100	
8	8.2136	.0079[5]		29,000	
9	8.8171[5]	.0090		30,600	
10	9.5391	.0118		37,100	

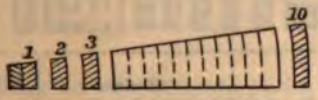
RING 1 AND 10 DETACHED. RINGS 2 TO 9 IN THE SLICE.

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
2	4.4006		.0100		68,100
3	5.0431[5]		.0064[5]		38,300
4	5.6864		.0017		8,900
5	6.3157[5]	.0019[5]		9,300	
6	6.9438[5]	.0045[5]		19,600	
7	7.5769	.0073[5]		29,100	
8	8.2147	.0090[5]		33,000	
9	8.8184	.0102[5]		34,900	
Exterior 9	8.9973[5]	.0101[5]		33,800	

RINGS 1, 2, AND 10 DETACHED. RINGS 3 TO 9 IN THE SLICE.

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
3	5.0404[5]	.....	.0091[5]	.....	54,400
4	5.6939	.....	.0041[5]	.....	21,800
5	6.3138[5]	.0000[5]	.....	200	.....
6	6.9419	.0026	.....	11,200	.....
7	7.5748[5]	.0053	.....	21,000	.....
8	8.2126[5]	.0070	.....	25,600	.....
9	8.8164	.0082[5]	.....	28,100	.....

RINGS 1, 2, 3, AND 10 DETACHED. RINGS 4 TO 9 IN THE SLICE.



Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
4	5.6914	.....	.0067	.....	35,300
5	6.3110	.....	.0028	.....	13,300
6	6.9396	.0003	.....	1,300	.....
7	7.5728	.0032[5]	.....	12,900	.....
8	8.2105	.0048[5]	.....	17,700	.....
9	8.8144	.0062[5]	.....	21,300	.....

RINGS 1, 2, 3, 4, AND 10 DETACHED. RINGS 5 TO 9 IN THE SLICE.

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
5	6.3091	.....	.0047	.....	22,300
6	6.9376[5]	.....	.0016[5]	.....	7,100
7	7.5710	.0014[5]	.....	5,700	.....
8	8.2088	.0031[5]	.....	11,500	.....
9	8.8127	.0046	.....	15,600	.....

RINGS 1, 2, 3, 4, 5, AND 10 DETACHED. RINGS 6 TO 9 IN THE SLICE.

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
6	6.9360	.....	.0033	.....	14,200
7	7.5092[5]	.....	.0003	.....	1,200
8	8.2073[5]	.0017	.....	6,200	.....
9	8.8111[6]	.0030	.....	10,200	.....

RINGS 1, 2, 3, 4, 5, 6, AND 10 DETACHED. RINGS 7, 8, AND 9 IN THE SLIC

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
7	7.5679[5]	.....	.0016	.....	6,300
8	8.2060[5]	.0004	.....	1,500	.....
9	8.8099[5]	.0018	.....	6,100	.....

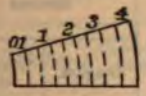
RINGS 1, 2, 3, 4, 5, 6, 7, AND 10 DETACHED. RINGS 8 AND 9 IN THE SLIC

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
8	8.2052	.....	.0004[5]	.....	1,600
9	8.8090	.0008[5]	.....	2,900	.....

MUZZLE SLICE, ANNEALED.

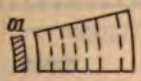
ATE OF INTERNAL STRAINS AND STRESSES AT DIFFERENT PHASES OF THE SLICE.

SLICE INTACT.



Rings.		Present mean diameter.	Strains.		Stresses per square inch.	
			Tension.	Compression.	Tension.	Compression.
		Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
Bore	01....	2.8260	.....	.0013[5]	.....	14,300
	1....	3.3650	.....	.0025[8]	.....	22,700
	2....	3.8974	.....	.0009	.....	6,900
	3....	4.4683[5]	.0009	.....	6,000	.....
	4....	5.2156	.0038	.....	21,800	.....
Exterior	4....	5.3486[5]	.0036	.....	20,200	.....

01 DETACHED. RINGS 1, 2, 3, AND 4 IN THE SLICE. INTERIOR DIAMETER OF SLICE NOW, 3".2±.



Ring.		Present mean diameter.	Strains.		Stresses per square inch.	
			Tension.	Compression.	Tension.	Compression.
		Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
	1....	3.3650[5]	.....	.0025	.....	22,300
	2....	3.8969[5]	.....	.0013[5]	.....	10,400
	3....	4.4681	.0006[5]	.....	4,300	.....
	4....	5.2150[5]	.0032[5]	.....	18,600	.....
Exterior	4....	5.3484	.0033[5]	.....	18,800	.....

RINGS 01 AND 4 DETACHED. RINGS 1, 2, AND 3 IN THE SLICE.

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1.....	3.3659[5]	.....	.0016	.....	14,230
2.....	3.8978[5]	.....	.0004[5]	.....	3,400
3.....	4.4689[5]	.0015	.....	2,000	.....

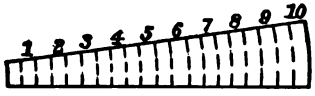
RINGS 01, 1, AND 4, DETACHED. RINGS 2 AND 3 IN THE SLICE.

Rings.	Present mean diameter.	Strains		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
2	3.8970⁵	.....	.0012⁵	.....	9,600
3	4.4684	.0009⁵	.....	6,400	.....

BREECH SLICE, ANNEALED.

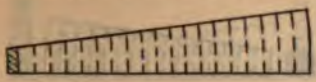
STATE OF INTERNAL STRAINS AND STRESSES AT DIFFEREN PHASES OF THE SLICE.

SLICE INTACT.



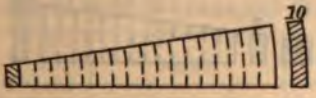
Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	3.8113	.....	.0034⁵	.....	27,200
2	4.4103⁵	.....	.0048⁵	.....	33,000
3	5.0501	.....	.0034⁵	.....	20,500
4	5.7031	.....	.0002	.....	1,000
5	6.3048⁵	.0010⁵	.....	7,800	.....
6	6.9616⁵	.0034	.....	14,600	.....
7	7.5728³	.0045⁵	.....	18,000	.....
8	8.2097⁵	.0053	.....	19,400	.....
9	8.8308⁵	.0059	.....	20,000	.....
10	9.5592	.0057	.....	17,900	.....
Exterior 10	9.7266	.0056	.....	17,300	.....

BORE OF SLICE TURNED DOWN TO 3".6 DIAMETER.



Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
1	3.8112	.....	.0035	.....	27,500
2	4.4101[5]	.....	.0050[5]	.....	34,300
3	5.0498	.....	.0017	.....	22,000
4	5.7029[5]	.....	.0003[5]	.....	1,800
5	6.3049	.0017	.....	8,100	.....
6	6.9616[5]	.0034	.....	14,600	.....
7	7.5726[5]	.0043[5]	.....	17,200	.....
8	8.2096	.0051[5]	.....	18,800	.....
9	8.8305[5]	.0056	.....	19,000	.....
10	9.5191	.0056	.....	17,600	.....

RING 10 DETACHED. RINGS 1 TO 9 IN THE SLICE.



Rings.		Present mean diameter.	Strains.		Stresses per square inch.	
			Tension.	Compression.	Tension.	Compression.
		Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
Interior	1	3.6025[7]	.....	.0035	.....	29,100
	1	3.8115	.....	.0032	.....	25,200
	2	4.4106	.....	.0046	.....	31,300
	3	5.0503	.....	.0032[5]	.....	19,300
	4	5.7031[5]	.....	.0001[5]	.....	800
	5	6.3051	.0019	.....	9,000	.....
	6	6.9621	.0038[5]	.....	16,600	.....
	7	7.5731[5]	.0048[5]	.....	19,200	.....
	8	8.2101	.0056[5]	.....	20,600	.....
	9	8.8313	.0063[5]	.....	21,500	.....
Exterior	9	8.9989	.0055[5]	.....	18,500	.....

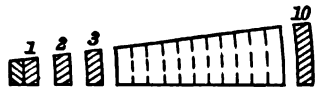
RINGS 1 AND 10 DETACHED. RINGS 2 TO 9 IN THE SLICE.

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
2	4.4094[5]	.....	.0057[5]	.....	39,100
3	5.0491[5]	.....	.0044	.....	26,100
4	5.7024	.....	.0009	.....	4,700
5	6.3041[5]	.0009[5]	.....	4,500	.....
6	6.9609[5]	.0027	.....	11,600	.....
7	7.5723	.0040	.....	15,800	.....
8	8.2093	.0048[5]	.....	17,700	.....
9	8.8305[5]	.0056	.....	19,000	.....

RINGS 1, 2, AND 10 DETACHED. RINGS 3 TO 9 IN THE SLICE.

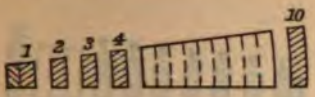
Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
3	5.0478	.....	.0057[5]	.....	34,100
4	5.7008[5]	.....	.0024[5]	.....	12,900
5	6.3028[5]	.....	.0003[5]	.....	1,600
6	6.9599	.0006[5]	.....	2,800	.....
7	7.5708[5]	.0025[5]	.....	10,100	.....
8	8.2081	.0030[5]	.....	13,300	.....
9	8.8294	.0044[5]	.....	15,100	.....

RINGS 1, 2, 3, AND 10 DETACHED. RINGS 4 TO 9 IN THE SLICE.



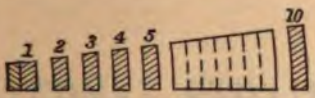
Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
4	5.6994	.....	.0039	.....	20,500
5	6.3015[5]	.....	.0016[5]	.....	7,800
6	6.9586	.0003[5]	.....	1,500	.....
7	7.5697	.0014	.....	5,500	.....
8	8.2069	.0024[5]	.....	8,900	.....
9	8.8282[5]	.0033	.....	11,200	.....

RINGS 1, 2, 3, 4, AND 10 DETACHED. RINGS 5 TO 9 IN THE SLICE.



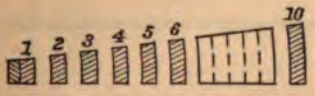
Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
5	6.3005	.....	.0027	.....	12,800
6	6.9575[5]	.....	.0007	.....	3,000
7	7.5686[5]	.0003[5]	.....	1,400	.....
8	8.2059[5]	.0015	.....	5,500	.....
9	8.8271	.0021[5]	.....	7,300	.....

RINGS 1, 2, 3, 4, 5, AND 10 DETACHED. RINGS 6 TO 9 IN THE SLICE.



Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
6	6.9567	.....	.0015[5]	.....	6,700
7	7.5677[5]	.....	.0005[5]	.....	2,200
8	8.2051[5]	.0007	.....	2,500	.....
9	8.8265	.0015[5]	.....	5,300	.....

RINGS 1, 2, 3, 4, 5, 6, AND 10 DETACHED. RINGS 7 TO 9 IN THE SLICE.



Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
7	7.5671[5]	.....	.0011[5]	.....	4,600
8	8.2045[5]	.0001	.....	400	.....
9	8.8258[5]	.0009	.....	3,100	.....

RINGS 1, 2, 3, 4, 5, 6, 7, AND 10 DETACHED. RINGS 8 AND 9 IN THE SLICE.

Rings.	Present mean diameter.	Strains.		Stresses per square inch.	
		Tension.	Compression.	Tension.	Compression.
	Inches.	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*
8	8.2040	.....	.0004[5]	.....	1,000
9	8.8255	.0005[5]	.....	1,900	.....

INTERNAL STRAINS

IN

EXPERIMENTAL STEEL FORGING.

PART 2.

MUZZLE SLICE.

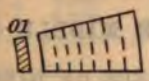
ORIGINAL DIAMETERS OF RINGS IN THE SLICE.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
Bore 01	2.8247	2.8250	2.8248[5]
1	3.3395	3.3396	3.3395[5]
2	3.8983	3.8972	3.8977[5]
3	4.4548	4.4571	4.4559[5]
4	5.2036	5.2053	5.2044[5]
Exterior 4	5.3485	5.3488	5.3486[5]

MUZZLE SLICE.

STRAINS RELEASED AS THE RINGS WERE SUCCESSIVELY DETACHED.

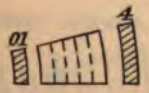
DETACHED. RINGS 1, 2, 3, AND 4 IN THE SLICE. INTERIOR DIAMETER OF SLICE NOW 3″.2±.



[Detached rings are shaded. Rings in the slice shown by open lines.]

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
Bore 01 detached	2.8294	2.8306	+.0047	+.0056	+.0051[5]
1	3.3383	3.3382	—.0012	—.0014	—.0013
2	3.8966	3.8961	—.0017	—.0011	—.0014
3	4.4553	4.4580	+.0005	+.0009	+.0007
4	5.2024	5.2046	—.0012	—.0007	—.0009[5]
Exterior 4	5.3473	5.3479	—.0012	—.0009	—.0010[5]

AND 4 DETACHED. RINGS 1, 2, AND 3 IN THE SLICE, 3″.2 AND 4″.6 INTERIOR AND EXTERIOR DIAMETERS.



Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
1	3.3403	3.3405	+.0008	+.0009	+.0008[5]
2	3.8988	3.8977	+.0005	+.0005	+.0005
3	4.4572	4.4599	+.0024	+.0028	+.0026
4	5.1990	5.1990	—.0046	—.0063	—.0054[5]
Exterior 4 detached	5.3434	5.3422	—.0051	—.0066	—.0058[5]

RINGS 01, 1, AND 4 DETACHED. RINGS 2 AND 3 IN THE SLICE, 9".75 AND 4".50 RIOR AND EXTERIOR DIAMETER.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
1 detached	3.3435	3.3431	+.0040	+.0035	+.0037[5]
2	3.3962	3.3962	—.0021	—.0010	—.0014[5]
3	4.4547	4.4580	—.0001	+.0009	+.0004

RINGS ALL DETACHED.

2 detached	3.3984	3.3986	+.0001	+.0014	+.0007[5]
3 detached	4.4526	4.4560	—.0022	—.0011	—.0016[5]

MUZZLE MIDDLE SLICE.

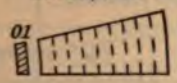
ORIGINAL DIAMETERS OF RINGS IN THE SLICE.

Rings.		Diameters.		
		A.	B.	Mean.
		Inches.	*Inches.*	*Inches.*
Bore	01	2.8327	2.8326	2.8326[5]
	1	3.3738	3.3744	3.3741
	2	4.0195	4.0204	4.0199[5]
	3	4.6563	4.6569	4.6566
	4	5.2566	5.2560	5.2563
	5	5.8913	5.8889	5.8901
Exterior	5	6.0577	6.0575	6.0576

MUZZLE MIDDLE SLICE.

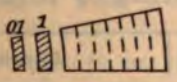
STRAINS RELEASED AS THE RINGS WERE SUCCESSIVELY DETACHED.

01 DETACHED. RINGS 1 TO 5 IN THE SLICE. INTERIOR DIAMETER OF SLICE, 3".2.



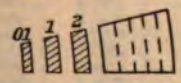
Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
Bore 01 detached..	2.8383	2.8379	+.0056	+.0043	+.0049[5]
	2.8379	2.8376	+.0052	+.0050	+.0051
Interior 1.....	3.2018	3.2019	.....	.....	.....
	3.2016	3.2017	.....	.....	.....
1.....	3.3725	3.3730	—.0013	—.0014	—.0013[5]
2.....	4.0184	4.0192	—.0011	—.0012	—.0011[5]
3.....	4.6550	4.6556	—.0013	—.0013	—.0013
4.....	5.2554	5.2547	—.0012	—.0013	—.0012[5]
5.....	5.8901	5.8878	—.0012	—.0011	—.0011[5]
Exterior 5.....	6.0567	6.0565	—.0010	—.0010	—.0010

RINGS 01 AND 1 DETACHED. RINGS 2, 3, 4, AND 5 IN THE SLICE.



Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
Interior 1 detached..	3.2089	3.2089	.....	.....	.....
	3.2085	3.2086	.....	.....	.....
1 detached..	3.3793	3.3797	+.0055	+.0053	+.0054
2.....	4.0155	4.0164	—.0040	—.0040	—.0040
3.....	4.6527	4.6531	—.0036	—.0038	—.0037
4.....	5.2532	5.2518	—.0034	—.0042	—.0038
5.....	5.8879	5.8854	—.0034	—.0035	—.0034[5]

RINGS 01, 1, AND 2 DETACHED. RINGS 3, 4, AND 5 IN THE SLICE.



Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
2 detached.....	4.0199	4.0213	+.0004	+.0009	+.0006[5]
3.....	4.6509	4.6504	—.0054	—.0065	—.0059[5]
4.....	5.2516	5.2497	—.0050	—.0063	—.0056[5]
5.....	5.8869	5.8832	—.0044	—.0057	—.0050[5]

RINGS 01, 1, 2, AND 3 DETACHED. RINGS 4 AND 5 IN THE SLICE. INT
DIAMETER, 5".18.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
3 detached	4.6518	4.6529	—.0045	—.0040	—.0042[6]
4	5.2520	5.2482	—.0046	—.0078	—.0062
5	5.8870	5.8815	—.0043	—.0074	—.0058[5]

RINGS ALL DETACHED.

4 detached	5.2500	5.2494	—.0066	—.0066	—.0066
5 detached	5.8865	5.8825	—.0048	—.0064	—.0056
Exterior 5 detached	6.0526	6.0507	—.0051	—.0068	—.0059[5]

BREECH MIDDLE SLICE.

ORIGINAL DIAMETERS OF RINGS IN THE SLICE.

Rings.		Diameters.		
		A.	B.	Mean.
		Inches.	*Inches.*	*Inches.*
Bore	01	2.8194	2.8191	2.8192[5]
	1	3.3774	3.3788	3.3781
	2	4.0108	4.0107	4.0107[5]
	3	4.6448	4.6471	4.6459[6]
	4	5.2683	5.2682	5.2682[5]
	5	5.9120	5.9065	5.9092[5]
	6	6.5118	6.5117	6.5117[5]
	7	7.0939	7.0936	7.0937[5]
	8	7.6624	7.6632	7.6628
	9	8.2550	8.2528	8.2539
Exterior	9	8.3945	8.3941	8.3943

BREECH MIDDLE SLICE.

TOTAL STRAINS RELEASED AS THE RINGS WERE SUCCESSIVELY DETACHED.

RING 01 DETACHED. RINGS 1 TO 9 IN THE SLICE.

Rings.	Present diameter.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
Bore 01 detached..	2.8263	2.8255	+.0069	+.0064	+.0066⁵
	2.8247	2.8237	+.0053	+.0046	+.0049⁵
Interior 1.....	3.2011	3.2011	.....	.....	.....
	3.2011	3.2011	.....	.....	.....
1.....	3.3760	3.3771	—.0014	—.0017	—.0015⁵
2.....	4.0096	4.0095	—.0012	—.0012	—.0012
3.....	4.6436	4.6457	—.0012	—.0014	—.0013
4.....	5.2678	5.2675	—.0010	—.0007	—.0008⁵
5.....	5.9113	5.9058	—.0007	—.0007	—.0007
6.....	6.5108	6.5109	—.0010	—.0008	—.0009
7.....	7.0932	7.0928	—.0007	—.0008	—.0007⁵
8.....	7.6619	7.6627	—.0005	—.0005	—.0005
9.....	8.2546	8.2522	—.0004	—.0006	—.0005
Exterior 9.....	8.3940	8.3939	—.0005	—.0002	—.0003⁵

RINGS 01 AND 1 DETACHED. RINGS 2 TO 9 IN THE SLICE. INTERIOR DIAMETER, 3″.83.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
Interior 1 detached..	3.2098	3.2099	.....	.....	.....
	3.2091	3.2090	.....	.....	.....
1 detached..	3.3845	3.3855	+.0071	+.0067	+.0069
2.....	4.0069	4.0069	—.0039	—.0038	—.0038⁵
3.....	4.6415	4.6435	—.0033	—.0036	—.0034⁵
4.....	5.2653	5.2651	—.0030	—.0031	—.0030⁵
5.....	5.9090	5.9038	—.0030	—.0027	—.0028⁵
6.....	6.5090	6.5090	—.0028	—.0027	—.0027⁵
7.....	8.0914	7.0908	—.0025	—.0028	—.0026⁵
8.....	7.6600	7.6610	—.0024	—.0022	—.0023
9.....	8.2526	8.2506	—.0024	—.0022	—.0023

RINGS 01, 1, AND 2 DETACHED. RINGS 3 TO 9 IN THE SLICE. INTERIOR DIAM
RING 3, 4".46.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
2 detached	4.0154	4.0152	+.0046	+.0045	+.0045[5]
3	4.6390	4.6409	—.0058	—.0062	—.0060
4	5.2630	5.2630	—.0053	—.0052	—.0052[5]
5	5.9070	5.9015	—.0050	—.0050	—.0050
6	6.5070	6.5070	—.0048	—.0047	—.0047[5]
7	7.0895	7.0890	—.0044	—.0046	—.0045
8	7.6583	7.6591	—.0041	—.0041	—.0041
9	8.2512	8.2489	—.0038	—.0039	—.0038[5]

RINGS 01, 1, 2, AND 3 DETACHED. RINGS 4 TO 9 IN THE SLICE. INTERIOR D
TER RING 4, 5".18.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
3 detached	4.6454	4.6472	+.0006	+.0001	+.0003[5]
4	5.2611	5.2608	—.0072	—.0074	—.0073
5	5.9052	5.8996	—.0068	—.0069	—.0068[5]
6	6.5052	6.5053	—.0066	—.0064	—.0065
7	7.0878	7.0875	—.0061	—.0061	—.0061
8	7.6567	7.6575	—.0057	—.0057	—.0057
9	8.2494	8.2470	—.0056	—.0058	—.0057

RINGS 01, 1, 2, 3, AND 4 DETACHED. RINGS 5 TO 9 IN THE SLICE. INTERIOR
TER RING 5, 5".71.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
4 detached	5.2662	5.2660	—.0021	—.0022	—.0021[5]
5	5.9035	5.8978	—.0085	—.0087	—.0086
6	6.5036	6.5036	—.0082	—.0081	—.0081[5]
7	7.0863	7.0858	—.0076	—.0078	—.0077
8	7.6551	7.6559	—.0073	—.0073	—.0073
9	8.2480	8.2456	—.0070	—.0072	—.0071

RINGS 01 TO 5 DETACHED. RINGS 6, 7, 8, AND 9 IN THE SLICE.

Rings.	Present diameter.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
5 detached	5.9079	5.9019	—.0041	—.0046	—.0043[5]
6	6.5026	6.5023	—.0098	—.0095	—.0094
7	7.0852	7.0842	—.0087	—.0094	—.0090[5]
8	7.6542	7.6544	—.0083	—.0088	—.0085
9	8.2470	8.2442	—.0080	—.0086	—.0083

RINGS 01 TO 6 DETACHED. RINGS 7, 8, AND 9 IN THE SLICE. INTERIOR DIAMETER RING 7, 6″.96.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
6 detached	6.5041	6.5058	—.0077	—.0064	—.0070[5]
7	7.0843	7.0833	—.0096	—.0103	—.0099[5]
8	7.6534	7.6534	—.0100	—.0098	—.0099
9	8.2461	8.2433	—.0089	—.0095	—.0091

RINGS 01 TO 7 DETACHED. RINGS 8 AND 9 IN THE SLICE. INTERIOR DIAMETER RING 8, 7″.5.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
7 detached	7.0852	7.0846	—.0087	—.0090	—.0089[5]
8	7.6527	7.6532	—.0097	—.0100	—.0098[5]
9	8.2458	8.2430	—.0092	—.0098	—.0095

RINGS ALL DETACHED.

8 detached	7.6533	7.6532	—.0091	—.0100	—.0095[5]
9 detached	8.2445	8.2454	—.0105	—.0074	—.0089[5]
Exterior 9 detached	8.3839	8.3865	—.0106	—.0076	—.0091

BREECH SLICE.

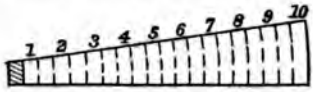
ORIGINAL DIAMETERS OF RINGS IN THE SLICE.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1.....	3.8051	3.8039	3.8045
2.....	4.4038	4.4020	4.4029
3.....	5.0449	5.0457	5.0453
4.....	5.6992	5.6970	5.6981
5.....	6.3180	6.3163	6.3171⁵
6.....	6.9461	6.9446	6.9453⁵
7.....	7.5785	7.5781	7.5783
8.....	8.2190	8.2125	8.2157⁵
9.....	8.8210	8.8179	8.8194⁵
10.....	9.5431	9.5394	9.5412⁵
Exterior 10.....	9.7261	9.7252	9.7256⁵

BREECH SLICE.

TOTAL STRAINS RELEASED AS THE RINGS WERE SUCCESSI DETACHED.

BORE OF SLICE TURNED OUT TO 3″.6 DIAMETER.



Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
1.....	3.8043	3.8029	—.0008	—.0010	—.0009
2.....	4.4032	4.4013	—.0006	—.0007	—.0006⁵
3.....	5.0442	5.0449	—.0007	—.0008	—.0007⁵
4.....	5.6987	5.6966	—.0005	—.0004	—.0004⁵
5.....	6.3177	6.3159	—.0003	—.0004	—.0003⁵
6.....	6.9457	6.9440	—.0004	—.0006	—.0005
7.....	7.5781	7.5776	—.0004	—.0005	—.0004⁵
8.....	8.2185	8.2122	—.0005	—.0003	—.0004
9.....	8.2205	8.8174	—.0005	—.0005	—.0005
10.....	9.5429	9.5390	—.0002	—.0004	—.0003

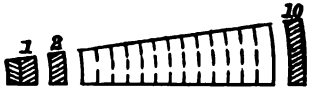
RING 1 DETACHED. RINGS 2 TO 10 IN THE SLICE.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
1 detached	3.8131	3.8122	+.0060	+.0083	+.0081[5]
2	4.4007	4.3968	—.0031	—.0034	—.0032[5]
3	5.0419	5.0426	—.0030	—.0031	—.0030[5]
4	5.6967	5.6944	—.0025	—.0026	—.0025[5]
5	6.3155	6.3139	—.0025	—.0024	—.0024[5]
6	6.9439	6.9421	—.0022	—.0025	—.0023[5]
7	7.5763	7.5780	—.0022	—.0021	—.0021[5]
8	8.2167	8.2105	—.0023	—.0020	—.0021[5]
9	8.8187	8.8156	—.0023	—.0023	—.0023
10	9.5409	9.5373	—.0022	—.0021	—.0021[5]

RINGS 1 AND 10 DETACHED. RINGS 2 TO 9 IN THE SLICE. EXTERIOR DIAMETER RING 9, 9″.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
2	4.4016	4.3996	—.0022	—.0024	—.0023
3	5.0429	5.0434	—.0020	—.0023	—.0021[5]
4	5.6976	5.6952	—.0016	—.0018	—.0017
5	6.3166	6.3149	—.0014	—.0014	—.0014
6	6.9447	6.9430	—.0014	—.0016	—.0015
7	7.5771	7.5767	—.0014	—.0014	—.0014
8	8.2179	8.2115	—.0011	—.0010	—.0010[5]
9	8.8199	8.8169	—.0011	—.0010	—.0010[5]
Exterior 9	8.9973	8.9974			
10 detached	9.5275	9.5271	—.0156	—.0123	—.0139[5]
Exterior 10 detached	9.7121	9.7140	—.0140	—.0112	—.0126

RINGS 1, 2, AND 10 DETACHED. RINGS 3 TO 9 IN THE SLICE. INTERIOR DIA
RING 3, 4″.86.



Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
2 detached	4.4115	4.4097	+.0077	+.0077	+.0077
3	5.0402	5.0407	—.0047	—.0050	—.0048
4	5.6952	5.6927	—.0040	—.0043	—.0041
5	6.3143	6.3124	—.0037	—.0039	—.0038
6	6.9428	6.9410	—.0033	—.0036	—.0034
7	7.5752	7.5745	—.0033	—.0036	—.0034
8	8.2159	8.2094	—.0031	—.0031	—.0031
9	8.8180	8.8148	—.0030	—.0031	—.0030

RINGS 1, 2, 3, AND 10 DETACHED. RINGS 4 TO 9 IN THE SLICE. INTERIOR DIA
RING 4, 5″.50.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
3 detached	5.0489	5.0503	+.0040	+.0046	+.0043
4	5.6926	5.6902	—.0066	—.0068	—.0067
5	6.3120	6.3100	—.0060	—.0063	—.0061
6	6.9405	6.9387	—.0056	—.0059	—.0057
7	7.5731	7.5725	—.0054	—.0056	—.0055
8	8.2138	8.2075	—.0052	—.0053	—.0052
9	8.8161	8.8127	—.0049	—.0052	—.0050

RINGS 1, 2, 3, 4, AND 10 DETACHED. RINGS 5 TO 9 IN THE SLICE. INTER
DIAMETER RING 5, 6″.13.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
4 detached	5.6903	5.6969	+.0001	—.0001	0.
5	6.3099	6.3083	—.0081	—.0080	—.0080
6	6.9385	6.9368	—.0076	—.0078	—.0077
7	7.5713	7.5707	—.0072	—.0074	—.0073
8	8.2121	8.2055	—.0069	—.0070	—.0069
9	8.8143	8.8112	—.0067	—.0067	—.0067

RINGS 1, 2, 3, 4, 5, AND 10 DETACHED. RINGS 6 TO 9 IN THE SLICE. INTERIOR DIAMETER RING 6, 6″.76.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
5 detached	6.3142	6.3134	—.0038	—.0029	—.0033[5]
6	6.9369	6.9351	—.0092	—.0095	—.0093[5]
7	7.5695	7.5690	—.0090	—.0091	—.0090[5]
8	8.2106	8.2041	—.0084	—.0084	—.0084
9	8.8128	8.8095	—.0082	—.0084	—.0083

RINGS 1, 2, 3, 4, 5, 6, AND 10 DETACHED. RINGS 7, 8, AND 9 IN THE SLICE. INTERIOR DIAMETER RING 7, 7″.38.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
6 detached	6.9404	6.9382	—.0057	—.0064	—.0060[5]
7	7.5681	7.5678	—.0104	—.0103	—.0103[5]
8	8.2093	8.2028	—.0097	—.0097	—.0097
9	8.8115	8.8084	—.0095	—.0095	—.0095

RINGS 1, 2, 3, 4, 5, 6, 7, AND 10 DETACHED. RINGS 8 AND 9 IN THE SLICE. INTERIOR DIAMETER RING 8, 8″.02.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
7 detached	7.5699	7.5692	—.0086	—.0089	—.0087[5]
8	8.2080	8.8024	—.0110	—.0101	—.0105[5]
9	8.8102	8.8078	—.0108	—.0101	—.0104[5]

RINGS ALL DETACHED.

8 detached	8.2080	8.2024	—.0110	—.0101	—.0105[5]
9 detached	8.8102	8.8078	—.0108	—.0101	—.0104[5]

MUZZLE SLICE, ANNEALED.

ORIGINAL DIAMETERS OF RINGS IN THE SLICE.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
Bore 01.....	2.8260	2.8260	2.8260
1.....	3.3655	3.3645	3.3650
2.....	3.8980	3.8968	3.8974
3.....	4.4688	4.4679	4.4683[5]
4.....	5.2181	5.2181	5.2156
Exterior 4.....	5.3486	5.3487	5.3486

MUZZLE SLICE, ANNEALED.

TOTAL STRAINS RELEASED AS THE RINGS WERE SUCCESSIVELY DETACHED.

RING 01 DETACHED. RINGS 1, 2, 3, AND 4 IN THE SLICE.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
Bore 01 detached...	2.8275	2.8272	+.0015	+.0012	+.0013[5]
1.....	3.3655	3.3646	.0000	+.0001	+.0000[5]
2.....	3.8979	3.8960	—.0001	—.0008	—.0004[5]
3.....	4.4687	4.4675	—.0001	—.0004	—.0002[5]
4.....	5.2126	5.2175	—.0005	—.0006	—.0005[5]
Exterior 4.....	5.3484	5.3484	—.0012	—.0003	—.0002[5]

RINGS 01 AND 4 DETACHED. RINGS 1, 2, AND 3 IN THE SLICE, 3″.2 AND 4″.6 INTERIOR AND EXTERIOR DIAMETERS.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
1	3.3664	3.3655	+.0009	+.0010	+.0009[5]
2	3.8986	3.8971	+.0006	+.0003	+.0004[5]
3	4.4693	4.4686	+.0005	+.0007	+.0006
4 detached..	5.2106	5.2130	—.0025	—.0051	—.0038
Exterior 4 detached..	5.3463	5.3438	—.0023	—.0049	—.0036

RINGS 01, 1, AND 4 DETACHED. RINGS 2 AND 3 IN THE SLICE, 3".75 AND 4."59 INTERIOR AND EXTERIOR DIAMETERS.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
1 detached	3.3677	3.3674	+.0022	+.0029	+.0025[5]
2	3.8978	3.8963	—.0002	—.0005	—.0003[5]
3	4.4688	4.4680	.0000	+ 0001	+.0000[5]

RINGS ALL DETACHED.

2 detached	3.8980	3.8977	+.0009	+.0009	+.0009
3 detached	4.4680	4.4669	—.0008	—.0010	—.0009

BREECH SLICE, ANNEALED.

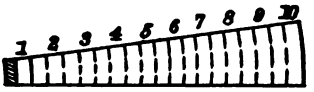
ORIGINAL DIAMETERS OF RINGS IN THE SLICE.

Rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
1	3.8113	3.8113	3.8113
2	4.4083	4.4124	4.4103[5]
3	5.0495	5.0507	5.0501
4	5.7032	5.7030	5.7031
5	6.3067	6.3030	6.3048[5]
6	6.9613	6.9620	6.9616[5]
7	7.5719	7.5738	7.5728[5]
8	8.2086	8.2109	8.2097[5]
9	8.8314	8.8303	8.8308[5]
10	9.5593	9.5591	9.5592
Exterior 10	9.7266	9.7266	9.7266

BREECH SLICE, ANNEALED.

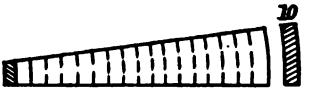
TOTAL STRAINS RELEASED AS THE RINGS WERE SUCCESSIVELY DETACHED.

BORE OF SLICE TURNED OUT TO 3."6 DIAMETER.



Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
1	3.8112	3.8112	—.0001	—.0001	—.0001
2	4.4080	4.4128	—.0008	—.0001	—.0002
3	5.0492	5.0505	—.0003	—.0002	—.0002[5]
4	5.7032	5.7027	.0000	—.0003	—.0001[5]
5	6.3068	6.3030	+.0001	.0000	+.0000[5]
6	6.9613	6.9620	0.	0.	0.
7	7.5717	7.5736	—.0002	—.0002	—.0002
8	8.2085	8.2107	—.0001	—.0002	—.0001[5]
9	8.8311	8.8300	—.0003	—.0003	—.0003
10	9.5592	9.5590	—.0001	—.0001	—.0001

RING 10 DETACHED. RINGS 1 TO 9 IN THE SLICE. EXTERIOR DIAMETER RING NO. 9, 9".00.



Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
Interior 1	3.6029	3.6030			
	3.6022	3.6022			
1	3.8116	3.8115	+.0003	+.0002	+.0002[5]
2	4.4085	4.4127	+.0002	+.0003	+.0002[5]
3	5.0498	5.0508	+.0003	+.0001	+.0002
4	5.7033	5.7030	+.0001	.0000	+.0000[5]
5	6.3070	6.3032	+.0003	+.0002	+.0002[5]
6	6.9618	6.9634	+.0005	+.0004	+.0004[5]
7	7.5722	7.5741	—.0003	+.0003	0.
8	8.2090	8.2112	+.0004	+.0003	+.0003[5]
9	8.8318	8.8308	+.0004	+.0005	+.0004[5]
Exterior 9	8.9990	8.9989			
10 detached.	9.5513	9.5557	—.0080	—.0034	—.0057
Exterior 10 detached.	9.7188	9.7232	—.0078	—.0034	—.0056

RINGS 1 AND 10 DETACHED. RINGS 2 TO 9 IN THE SLICE. INTERIOR DIAMETER RING 2, 4".24.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
Interior 1 detached..	3.6036	3.6033	+.0037	+.0033	+.0035
1 detached..	3.6056	3.6056	+.0036	+.0034	+.0035
	3.8149	3.8146	+.0036	+.0033	+.0034⅝
2	4.4073	4.4118	—.0010	—.0008	—.0009
3	5.0486	5.0497	—.0009	—.0010	—.0009½
4	5.7026	5.7022	—.0026	—.0008	—.0007
5	6.3039	6.3028	—.0007	—.0007	—.0007
6	6.9608	7.9611	—.0005	—.0009	—.0007
7	7.5714	7.5722	—.0005	—.0006	—.0005½
8	8.2081	8.2105	—.0005	—.0004	—.0004⅝
9	8.8311	8.8309	—.0003	—.0003	—.0003

RINGS 1, 2, AND 10 DETACHED. RINGS 3 TO 9 IN THE SLICE. INTERIOR DIAMETER RING 2, 4".36.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
2 detached	4.4131	4.4173	+.0048	+.0049	+.0048⅝
3	5.0472	5.0484	—.0023	—.0022	—.0023
4	5.7011	5.7006	—.0021	—.0024	—.0022⅝
5	6.3047	6.3010	—.0020	—.0020	—.0020
6	6.9596	6.9602	—.0017	—.0018	—.0017½
7	7.5699	7.5718	—.0020	—.0020	—.0020
8	8.2069	8.2093	—.0017	—.0016	—.0016⅝
9	8.8300	8.8288	—.0014	—.0015	—.0014⅝

RINGS 1, 2, 3, AND 10 DETACHED. RINGS 4 TO 9 IN THE SLICE.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
3 detached	5.9527	5.0540	+.0032	+.0033	+.0032[5]
4	5.6995	5 6993	—.0037	—.0037	—.0037
5	6.3035	6.2996	—.0032	—.0034	—.0033
6	6.9583	6.9589	—.0030	—.0031	—.0030[5]
7	7.5687	7.5707	—.0032	—.0031	—.0031[5]
8	8.2057	8.2081	—.0029	—.0028	—.0028[5]
9	8.8288	8.8277	—.0026	—.0026	—.0026

RINGS 1, 2, 3, 4, AND 10 DETACHED. RINGS 5 TO 9 IN THE SLICE. INTERIOR DIAMETER RING 5, 6".13.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
4 detached	5.7036	5.7030	+.0004	.0000	+.0002
5	6.3023	6.2987	—.0044	—.0043	—.0043[5]
6	6.9572	6.9579	—.0041	—.0041	—.0041
7	7.5677	7.5690	—.0042	—.0042	—.0042
8	8.2048	8.2071	—.0038	—.0038	—.0038
9	8.8277	8.8265	—.0037	—.0038	—.0037[5]

RINGS 1, 2, 3, 4, 5, AND 10 DETACHED. RINGS 6 TO 9 IN THE SLICE. INTERIOR DIAMETER RING 6, 6".76.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
5 detached	6.3052	6.3012	—.0015	—.0018	—.0016[5]
6	6.9564	6.9570	—.0049	—.0050	—.0049[5]
7	7.5668	7.5687	—.0051	—.0051	—.0051
8	8.2040	8.2063	—.0046	—.0046	—.0046
9	8.8270	8.8260	—.0044	—.0043	—.0043[5]

RINGS 1, 2, 3, 4, 5, 6, AND 10 DETACHED. RINGS 7, 8, AND 9 IN THE SLICE. INTERIOR DIAMETER RING 7, 7″.38.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
6 detached	6.9578	6.9567	—.0035	—.0033	—.0034
7	7.5662	7.5681	—.0057	—.0057	—.0057
8	8.2035	8.2056	—.0051	—.0053	—.0052
9	8.8264	8.8253	—.0050	—.0050	—.0050

RINGS 1, 2, 3, 4, 5, 6, 7, AND 10 DETACHED. RINGS 8 AND 9 IN THE SLICE. INTERIOR DIAMETER RING 8, 8″.02.

Rings.	Present diameters.		Strains released.		
	A.	B.	Diameter A.	Diameter B.	Mean.
	Inches.	*Inches.*	*Inch.*	*Inch.*	*Inch.*
7 detached	7.5672	7.5694	—.0047	—.0044	—.0045[5]
8	8.2029	8.2051	—.0057	—.0058	—.0057[8]
9	8.8260	8.8250	—.0054	—.0053	—.0053[5]

RINGS ALL DETACHED.

8 detached	8.2029	8.2051	—.0057	—.0058	—.0057[8]
9 detached	8.8260	8.8250	—.0054	—.0053	—.0053[5]

INTERNAL STRAINS

IN

EXPERIMENTAL STEEL FORGING.

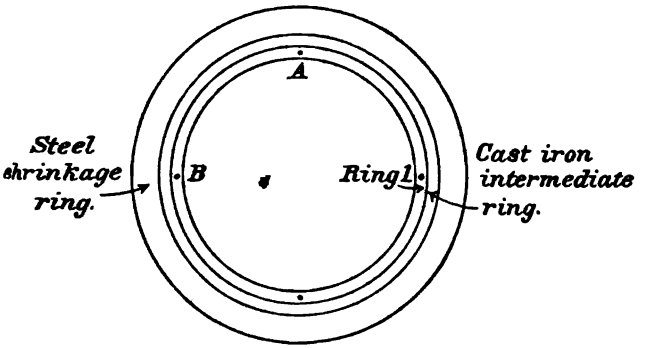
PART 3.

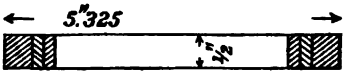
SUPPLEMENTARY TESTS MADE WITH THE RINGS AFTER THEY WERE DETACHED FROM THEIR RESPECTIVE SLICES.

TEST WITH AUGMENTED COMPRESSION MADE WITH RING 1, BREECH SLICE, NOT ANNEALED.

The maximum compression stress received by this ring in the slice was 71,400 pounds per square inch.

Compression stress applied to ring 1 by means of a steel shrinkage ring assembled over a cast-iron intermediate ring.



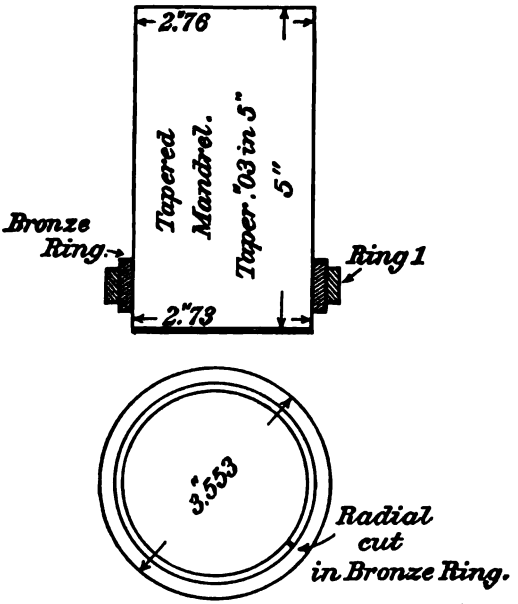


Condition of ring 1.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
In detached state	3.8133	3.8120	3.8126
Assembled with cast-iron intermediate ring and steel shrinkage ring in place	3.7907	3.7975	3.7941
Final state of detached ring	3.8036	3.8082	3.8059

TENSILE STRESS APPLIED TO RING 1, BREECH MIDDLE SLICE, NOT ANNEALED.

The maximum compression stress received by this ring in the slice was 78,200 pounds per square inch at the inner diameter.

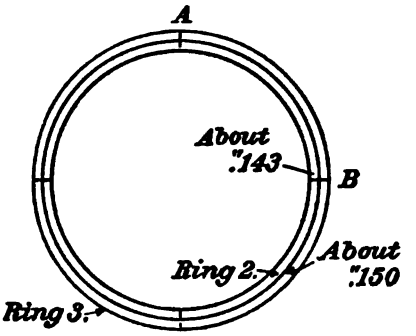
Tensile stress applied by means of a tapering mandrel and intermediate bronze ring.



Applied loads on mandrel.	Exterior diameter of ring.	Expansion of diameter.	Permanent set of diameter.
Pounds.	*Inches.*	*Inch.*	*Inch.*
0	3.5530	.....	.....
1,000	3.5547	.0017	.....
1,500	3.5557	.0027	.....
1,800	3.5565	.0035	.....
0	3.5534+	.....	.0004+
2,000	3.5580	.0050	.....
0	3.5535	.....	.0005+
2,200	3.5587	.0057	.....
2,500	3.5594	.0064	.....
0	3.5537	.....	.0007
3,300	3.5609	.0079	.....
0	3.5547	.....	.0017
3,400	3.5629	.0099	.....
0	3.5558	.....	.0028
3,000	3.5695	.0165	.....
0	3.5620	.....	.0090
3,250	3.5769	.0239	.....
0	3.5671	.....	.0141
Required 5,300 pounds to push off the ring which was forced on with 3,250 pounds. After the ring was started off about ".03 the resistance fell to about 3,000 pounds.			
2,260	3.5776	.0246	.....
0	3.5679	.....	.0149

ANNEALING TEST OF RINGS SHRUNK TOGETHER.

Rings used: No. 2 from breech slice, not annealed; No. 3 from breech middle slice, not annealed.



Before shrinking together the rings were turned to the following dimensions:

	Inches.
Exterior diameter ring 2	4.5275
Interior diameter ring 3	4.5175
Difference	.0100

Condition of rings.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
Ring 2 detached	4.4117	4.4099	4.4108
Ring 3 detached	4.6454	4.6475	4.6464⅝
Ring 2 assembled	4.4073	4.4016	4.4044⅝
Ring 3 assembled	4.6509	4.6510	4.6509⅝
Assembled rings heated to a light blue color, estimated temperature 700° F., then cooled and diameters measured.			
Ring 2 assembled	4.4074	4.4016	4.4045
Ring 3 assembled	4.6513	4.6510	4.6511⅝
Assembled rings heated dull red color, estimated temperature 1,050° F.			
Ring 2 assembled	4.4035	4.4092	4.4063⅝
Ring 3 assembled	4.6500	4.6560	4.6530
Assembled rings heated red color, estimated temperature 1,150° F.			
Ring 2 assembled	4.4130	4.3941	4.4035⅝
Ring 3 assembled	4.6563	4.6457	4.6510
Rings detached; forced apart by overcoming the frictional resistance between the shrinkage.			
Ring 2 detached	4.4132	4.3939	4.4035⅝
Ring 3 detached	4.6556	4.6460	4.6508

ANNEALING TESTS OF DETACHED RINGS FROM BREECH SLICE, ANNEALED.

Measurement of diameters after exposure to successive annealing temperatures.

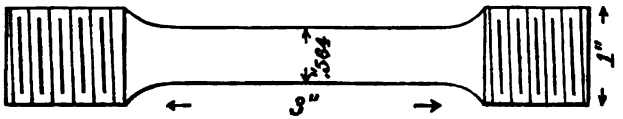
Rings exposed to temperature of 212° F. in boiling water.

Ring.	Diameters.		
	A.	B.	Mean.
	Inches.	*Inches.*	*Inches.*
3	5.0525	5.0537	5.0531
4	5.7035	5.7029	5.7032
Measurement of rings after exposure in oil bath to a temperature of 400° F.			
3	5.0525	5.0537	5.0531
4	5.7035	5.7028	5.7031[5]
Rings exposed in sand bath to temperature of about 700° F.			
3	5.0525	5.0539	5.0532
4	5.7035	5.7028	5.7031[5]
Rings exposed to low red heat, estimated temperature 1,050° F.			
3	5.0545	5.0567	5.0556
4	5.7061	5.7027	5.7044

WROUGHT-IRON CASTING.

SAMPLE FROM A SPRUE FURNISHED BY THE WROUGHT IRON CASTING COMPANY.

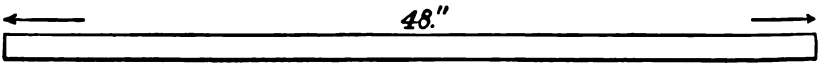
Form of specimen.



Sectional area, .25 square inch.
Elastic limit, 6,380 pounds=25,520 pounds per square inch.
Tensile strength, 12,140 pounds=48,560 pounds per square inch.
Elongation in 3 inches, ".13=4.3 per cent.
Elongation of inch sections, ".03, ".05*, ".05*.
Diameter at fracture, ".54; area, .229 square inch.
Contraction of area, 8.4 per cent.
Appearance of fracture: Granular, 80 per cent; dull spongy, 20 per cent. Opened cracks in the surface of the stem.

TENSILE TEST OF A BAR OF BURDEN'S IRON

No. 7827.

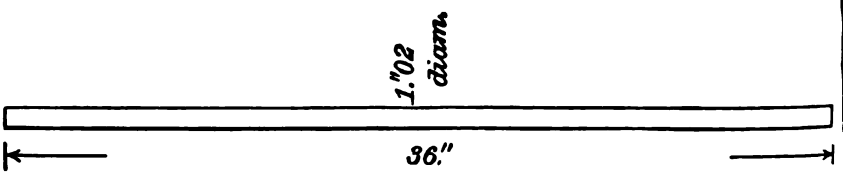


Diameter, 1".52.
Sectional area, 1.81 square inches.
Elastic limit, 51,600 pounds=28,510 pounds per square inch.
Tensile strength, 86,080 pounds=47,560 pounds per square inch.
Diameter at fracture, 1".13; area, 1.00 square inch.
Contraction of area, 44.7 per cent.
Elongation in 18 inches, 4.90=27.2 per cent.
Elongation of inch sections, ".22, ".20, ".23, ".28, ".25, ".23, ".23, ".24, ".24, ".22, ".23, ".25, ".24, ".25, ".29, ".36, ".69.
Appearance of fracture, fibrous.

NORWAY IRON.

TENSION TEST OF SAMPLE FROM WHICH CHAINS NOS. 7616 AND 7617 WERE MADE.

No. 7618.



Sectional area, .817 square inch.
Elastic limit, 17,800 pounds=21,780 pounds per square inch.
Tensile strength, 32,200 pounds=39,410 pounds per square inch.
Elongation in 12 inches, 3".22=26.0 per cent.
Elongation of inch sections, ".24, ".23, ".24, ".25, ".26, ".23, ".24, ".24, ".25, ".27, ".30, ".47.
Diameter at fracture, ".57; area, .255 square inch.
Contraction of area, 68.8 per cent.
Appearance of fracture, fibrous. Fractured outside the gauged section.

TENSILE TEST OF A BAR OF ULSTER IRON.

USED FOR TRUSS ROD IN CRANE WAY OF WATERTOWN ARSENAL SETTING-UP SHOP.

No. 7316.

Total length of bar, 48″.
Diameter, 2″.02.
Sectional area, 3.20 square inches.
Elastic limit, 94,900 pounds = 29,660 pounds per square inch.
Tensile strength, 154,100 pounds = 48,160 pounds per square inch.
Elongation in 15 inches, 3″.97 = 26.5 per cent.
Elongation of inch sections, ″.20, ″.21, ″.21, ″.21, ″.23, ″.23, ″.21, ″.21, ″.21, ″.22, ″.30, ″.65*, ″.39, ″.26, ″.23.
Diameter at fracture, 1″.56; area, 1.91 square inches.
Contraction of area, 40.3 per cent.
Appearance of fracture, fibrous, seamy.

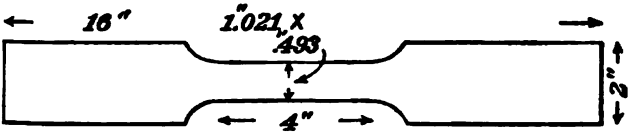
RIVETED JOINTS.

MATERIAL FURNISHED BY AND TESTED FOR THE AMERICAN BOILER MANUFACTURERS' ASSOCIATION OF THE UNITED STATES AND CANADA.

No. 7298.

STEEL PLATE.

Specimen representing material used in riveted joints Nos. 7300 and 7303.



Sectional area, .503 square inch.
Elastic limit, 23,860 pounds = 47,430 pounds per square inch.
Tensile strength, 34,570 pounds = 68,730 pounds per square inch.
Elongation in 4 inches, ".91 = 22.7 per cent.
Elongation of inch sections, ".16, ".45*, ".20, ".10.
Area at fracture, ".81 × ".38 = .308 square inch.
Contraction of area, 38.8 per cent.
Appearance of fracture, silky.

No. 7299.

Drilled holes, $\frac{15}{16}''$ diameter.
Burden's iron rivets, $\frac{7}{8}''$ diameter.
Machine riveted.

Gross sectional area of plate	square inches..	8.56
Net sectional area of plate	do....	6.15
Bearing surface of rivets	do....	6.02
Shearing area of rivets	do....	17.94

Gauged length, 15″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
8,560	1,000	0.	0.	Initial load.
17,120	2,000	.0005	.....	
25,680	3,000	.0010	.....	
34,240	4,000	.0014	.....	
42,800	5,000	.0019	0.	
51,360	6,000	.0024	.....	
59,920	7,000	.0028	.....	
68,480	8,000	.0033	.....	Snapping sound.
77,040	9,000	.0038	.....	
85,600	10,000	.0044	.0001	
94,160	11,000	.0049	.....	
102,720	12,000	.0055	.....	
111,280	13,000	.0061	.....	
119,840	14,000	.0070	.....	
128,400	15,000	.0077	.0011	
136,960	16,000	.0088	.....	
145,520	17,000	.0099	.....	
154,080	18,000	.0109	.....	
162,640	19,000	.0123	.....	
171,200	20,000	.0138	.0051	
179,760	21,000	.0160	.....	
188,320	22,000	.0175	.....	
196,880	23,000	.0190	.....	
205,440	24,000	.0201	.....	
214,000	25,000	.0514	.0099	
393,100	45,920	.....	.....	Tensile strength.

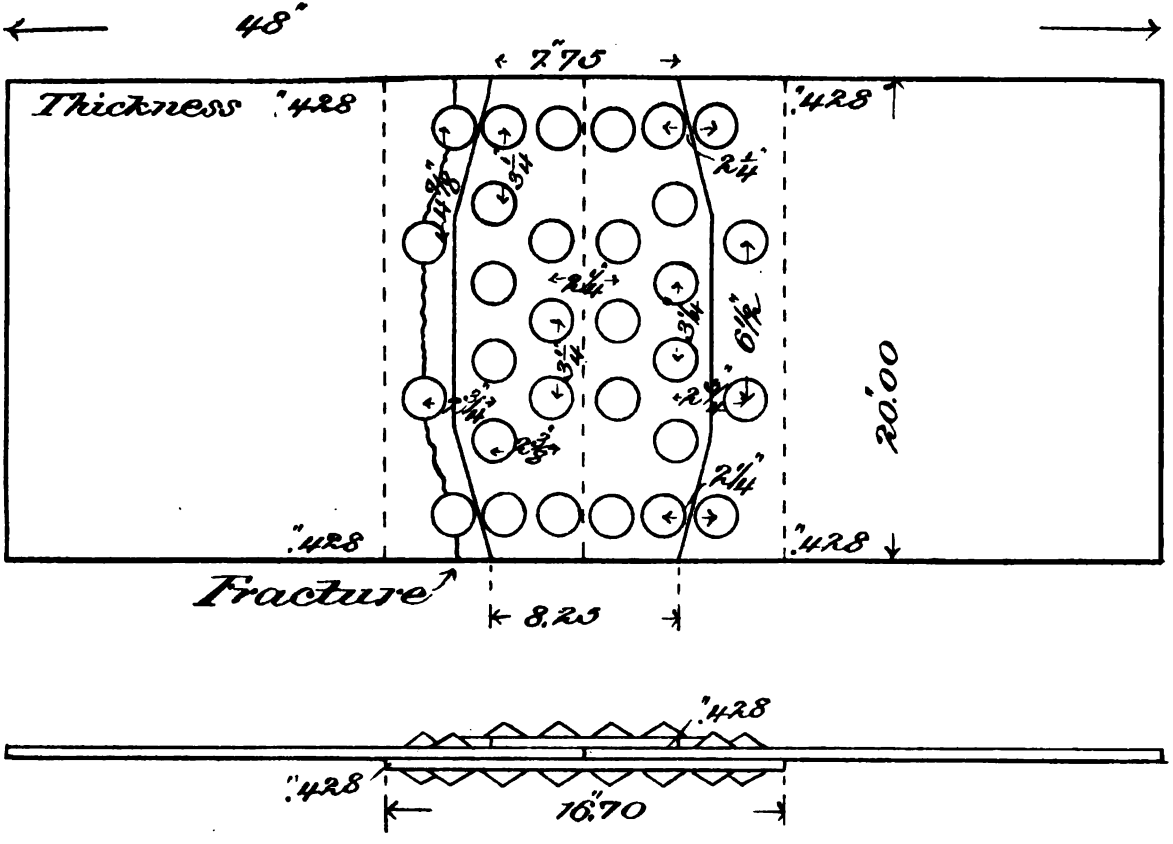
Fractured the plate along the outside row of rivet holes. Fracture began at the edge of the specimen. Appearance of fractures, silky.

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch..	45,920
Tension on net section of plate	do....	63,920
Compression on bearing surface of rivets	do....	65,300
Shearing on rivets	do....	21,910

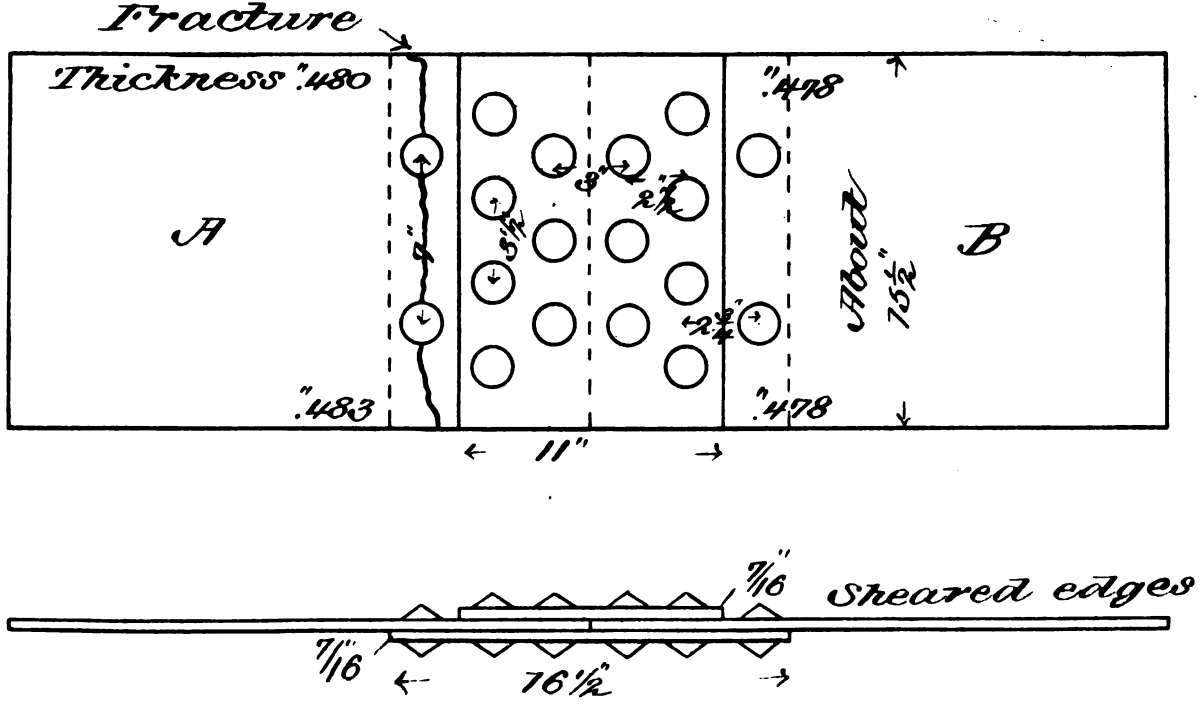
No. 7299

Mark 1.



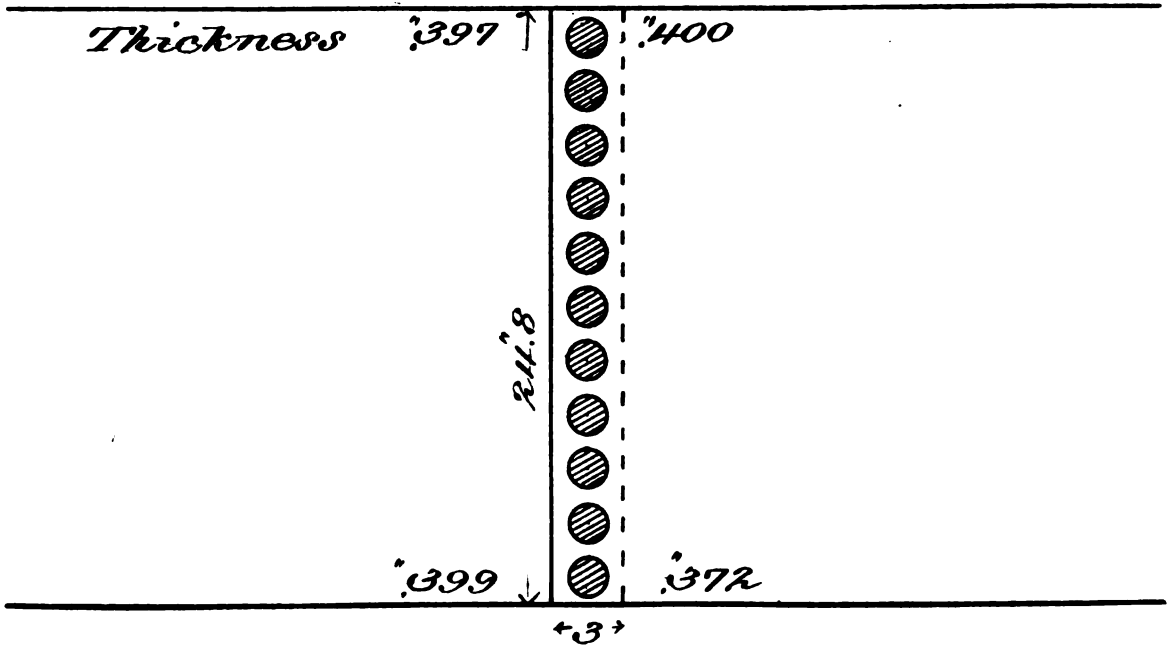
THE ROBERTS FILTER CO. PHILADELPHIA, PA.

No. 7300 Marks C S 2 & S



THE HOBBS PETER CO. PHOTO-LITHO WASHINGTON D.C.

No. 7301



No. 7300.

Holes punched $\frac{13}{16}$″ and drilled to $\frac{15}{16}$″ diameter.
Sternbergh steel rivets, $\frac{7}{8}$″ diameter.

Gross sectional area of plate A	square inches..	7.46
Net sectional area of plate A	do....	5.66
Bearing surface of rivets	do....	4.06
Shearing area of rivets	do....	11.04

Tensile strength, 337,800 pounds.
Fractured plate A along outside row of rivet holes. Appearance, silky.

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch..	45,280
Tension on net section of plate	do....	59,680
Compression on bearing surface of rivets	do....	83,200
Shearing on rivets	do....	30,600

Efficiency of joint, 65.9 per cent.

No. 7301.

Holes reamed ".815 diameter.
Sternbergh steel rivets.

Gross sectional area of plate	square inches..	9.57
Net sectional area of plate	do....	6.11
Bearing surface of rivets	do....	3.46
Shearing area of rivets	do....	5.74

Tensile strength, 255,600 pounds.
Sheared the rivets.
Elongation of rivet holes, ".05 .

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch..	26,710
Tension on net section of plate	do....	41,830
Compression on bearing surface of rivets	do....	73,870
Shearing on rivets	do....	44,530

No. 7302.

Holes reamed ″.815 diameter.
Burden's iron rivets.

Gross sectional area of plate	square inches..	9.928
Net sectional area of plate	do....	6.342
Bearing surface of rivets	do....	3.586
Shearing area of rivets	do....	5.74

Gauged length, 15″.

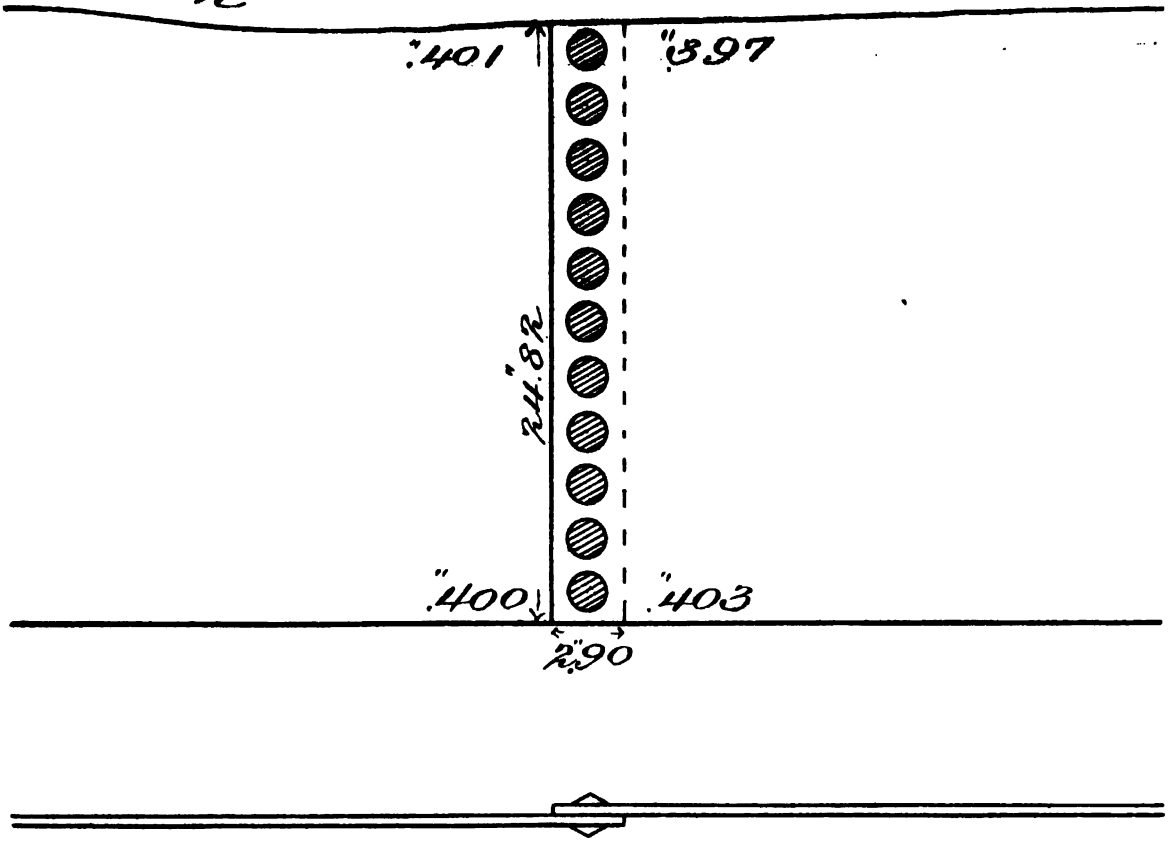
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
9,928	1,000	0.	0.	Initial load.
19,856	2,000	.0011	.....	
29,784	3,000	.0024	.....	
39,712	4,000	.0038	.....	
49,640	5,000	.0057	.0020	
59,568	6,000	.0078	.....	
69,496	7,000	.0107	.....	
79,424	8,000	.0134	.....	
89,352	9,000	.0155	.....	
99,280	10,000	.0192	.0092	
109,208	11,000	.0224	.....	
119,136	12,000	.0254	.....	
129,064	13,000	.0295	.....	
138,992	14,000	.0353	.....	
148,920	15,000	.0479	.0277	
158,848	16,000	.06	.....	
182,000	.....	.....	.....	Plate begins to scale.
226,100	22,770	.....	.....	Tensile strength.

Sheared the rivets.
Elongation of rivet holes, ″.05.

Maximum stress on joint.

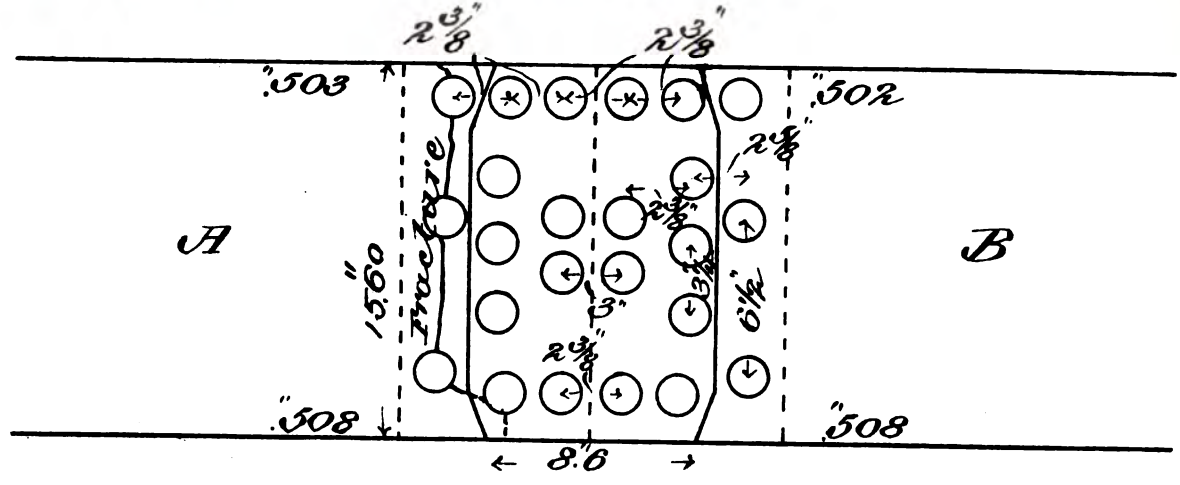
Tension on gross section of plate	pounds per square inch..	22,770
Tension on net section of plate	do....	35,650
Compression on bearing surface of rivets	do....	63,050
Shearing on rivets	do....	39,390

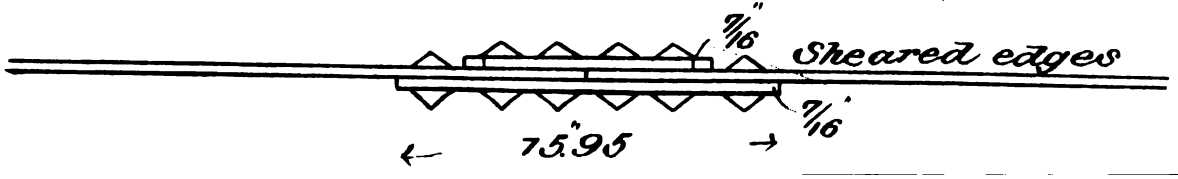
No. 7302



THE HORNER PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 7303 Marks C S & S





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No. 7303.

Holes punched $\frac{15}{16}$″ and drilled to $\frac{15}{16}$″ diameter.
Sternbergh steel rivets, $\frac{7}{8}$″ diameter.

Gross sectional area plate A	square inches..	7.88
Net sectional area plate A	do....	5.51
Bearing surface of rivets	do....	5.69
Shearing area of rivets	do....	14.49

Gauged length, 15″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
7,860	1,000	0.	0.	Initial load.
39,480	5,000	.0015	0.	
78,960	10,000	.0044	— .0002	
118,200	15,000	.0084	+ .0002	
126,060	16,000	.0094	.....	
133,980	17,000	.0106	.....	
141,840	18,000	.0122	.....	
149,720	19,000	.0135	.....	
157,600	20,000	.0154	.0032	
165,480	21,000	.0177	.....	
173,360	22,000	.0196	.....	
181,240	23,000	.0212	.....	
189,120	24,000	.0223	.....	
197,000	25,000	.0263	.0103	
204,880	26,000	.0289	.....	
212,760	27,000	.0307	.....	
220,640	28,000	.0329	.....	
228,520	29,000	.0352	.....	
236,400	30,000	.0379	.0177	
244,280	31,000	.0412	.....	
252,160	32,000	.0456	.....	
260,040	33,000	.0580	.....	
342,800	43,630	.....	.....	Tensile strength.

Fractured plate A along outside row of rivet holes, beginning at one edge of the plate.

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch..	43,630
Tension on net section of plate	do....	62,400
Compression on bearing surface of rivets	do....	60,420
Shearing on rivets	do....	23,730

No. 7304.

Holes punched $\frac{15}{16}$″ diameter.
Burden's iron rivets, $\frac{7}{8}$″ diameter.
Hand riveted.

Gross sectional area of plate A.....square i
Net sectional area of plate A.....
Bearing surface of rivets .....
Shearing area of rivets .....

Gauged length, 15″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
8,470	1,000	0.	0.	Initial load.
42,350	5,000	.0046	—.0006	
84,700	10,000	.0108	—.0001	
127,050	15,000	.0152	.0011	
135,520	16,000	.0161	.....	
143,990	17,000	.0171	.....	
152,460	18,000	.0181	.....	
160,930	19,000	.0191	.....	
169,400	20,000	.0201	.0033	
177,870	21,000	.0214	.....	
186,340	22,000	.0227	.....	
194,810	23,000	.0240	.....	
203,280	24,000	.0252	.....	
211,750	25,000	.0263	.0063	
220,220	26,000	.0279	.....	
228,690	27,000	.0292	.....	
237,160	28,000	.0301	.....	
245,630	29,000	.0320	.....	
254,100	30,000	.0332	.0111	
262,570	31,000	.0366	.....	
271,040	32,000	.0397	.....	
279,510	33,000	.0444	.....	
287,980	34,000	.0550	.....	
378,700	44,710	.....	.....	Tensile strength.

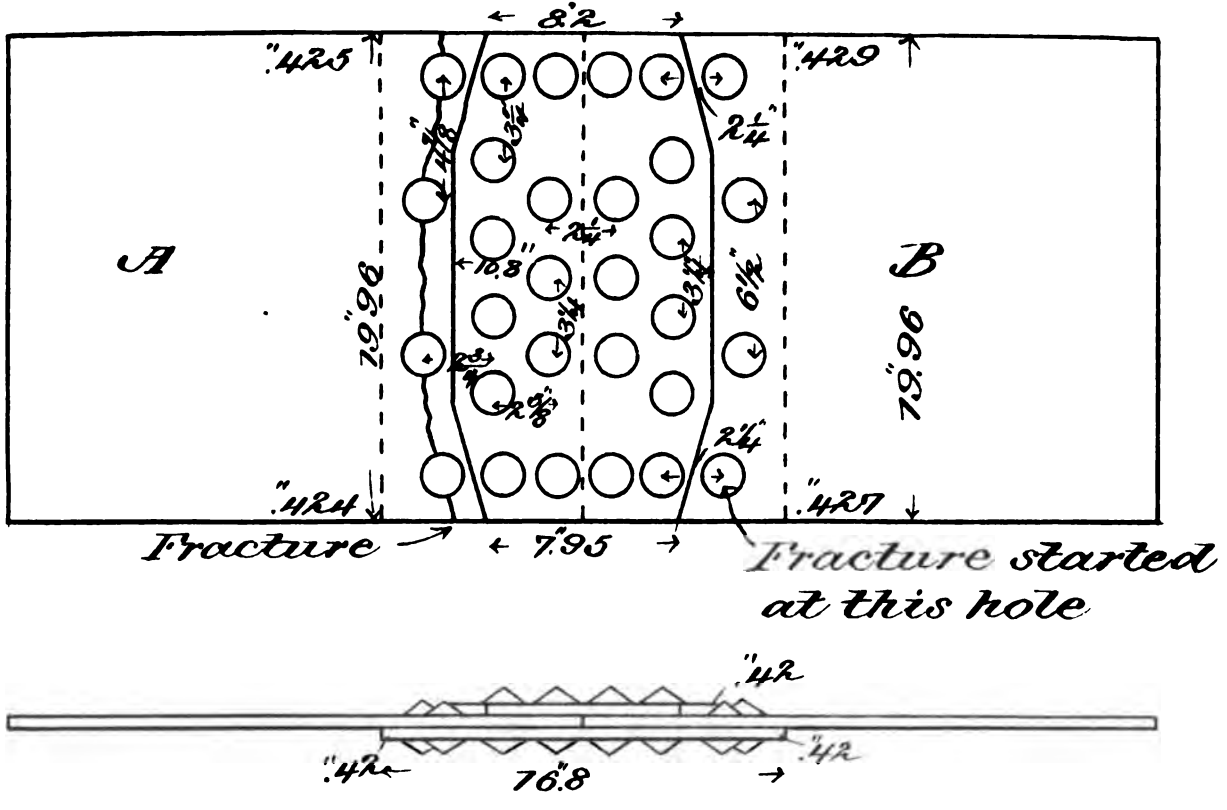
Fractured along outside row of rivet holes. The fractu
one edge of the sheet and tore across the specimen. A
silky.

Maximum stress on joint.

Tension on gross section of plate .....pounds per square
Tension on net section of plate .....
Compression on bearing surface of rivets .....
Shearing on rivets.....

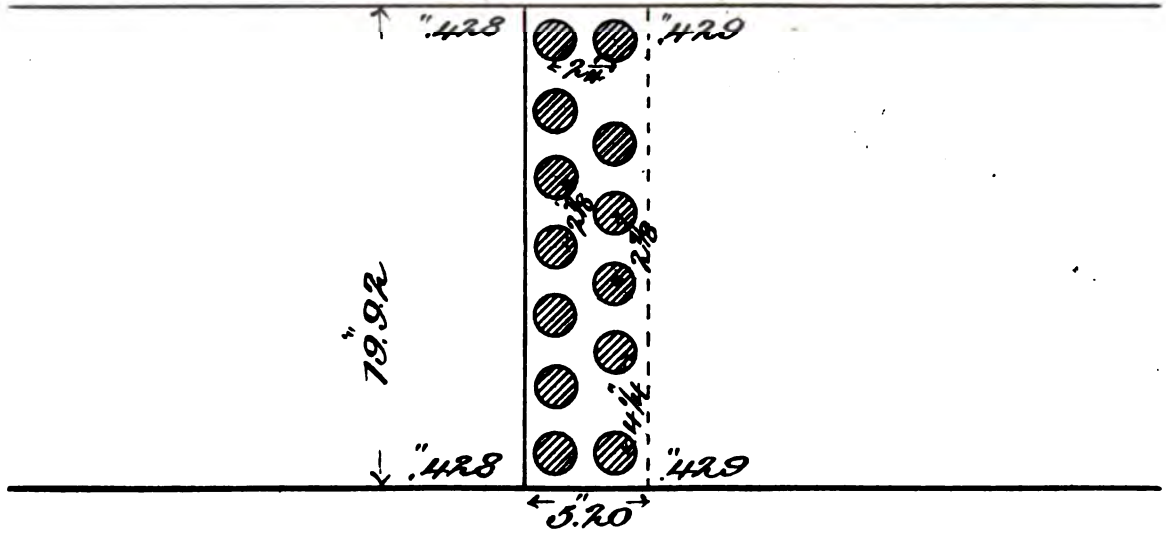
No. 7304

Mark 3



THE NORMA PETERS CO PHOTOLITHO WASHINGTON, D. C.

No. 7305 Mark 2



THE BOBBS-MERRILL CO PHOTO-LITHO WASHINGTON D C

No. 7305.

Holes drilled $1\frac{5}{8}$" diameter.
Burden's iron rivets, $\frac{7}{8}$" diameter.
Machine riveted.

Gross sectional area of plate A	square inches	8.52
Net sectional area of plate A	do	5.72
Bearing surface of rivets	do	5.22
Shearing area of rivets	do	8.97

Gauged length, 15".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
8,520	1,000	0.	0.	Initial load.
17,040	2,000	.0023	.....	
25,560	3,000	.0049	.....	
34,080	4,000	.0082	.....	
42,600	5,000	.0099	.0009	
51,120	6,000	.0112	.....	
59,640	7,000	.0128	.....	
68,160	8,000	.0141	.....	
76,680	9,000	.0152	.....	
85,200	10,000	.0165	.0017	
93,720	11,000	.0179	.....	
102,240	12,000	.0195	.....	
110,760	13,000	.0213	.....	
119,280	14,000	.0234	.....	
127,800	15,000	.0259	.0080	
136,320	16,000	.0287	.....	
144,840	17,000	.0324	.....	
153,360	18,000	.0378	.....	
161,880	19,000	.0428	.....	
170,400	20,000	.0487	.0265	
178,920	21,000	.0544	.....	
187,440	22,000	.0598	.....	
358,980	42,120	.....	.....	Tensile strength.

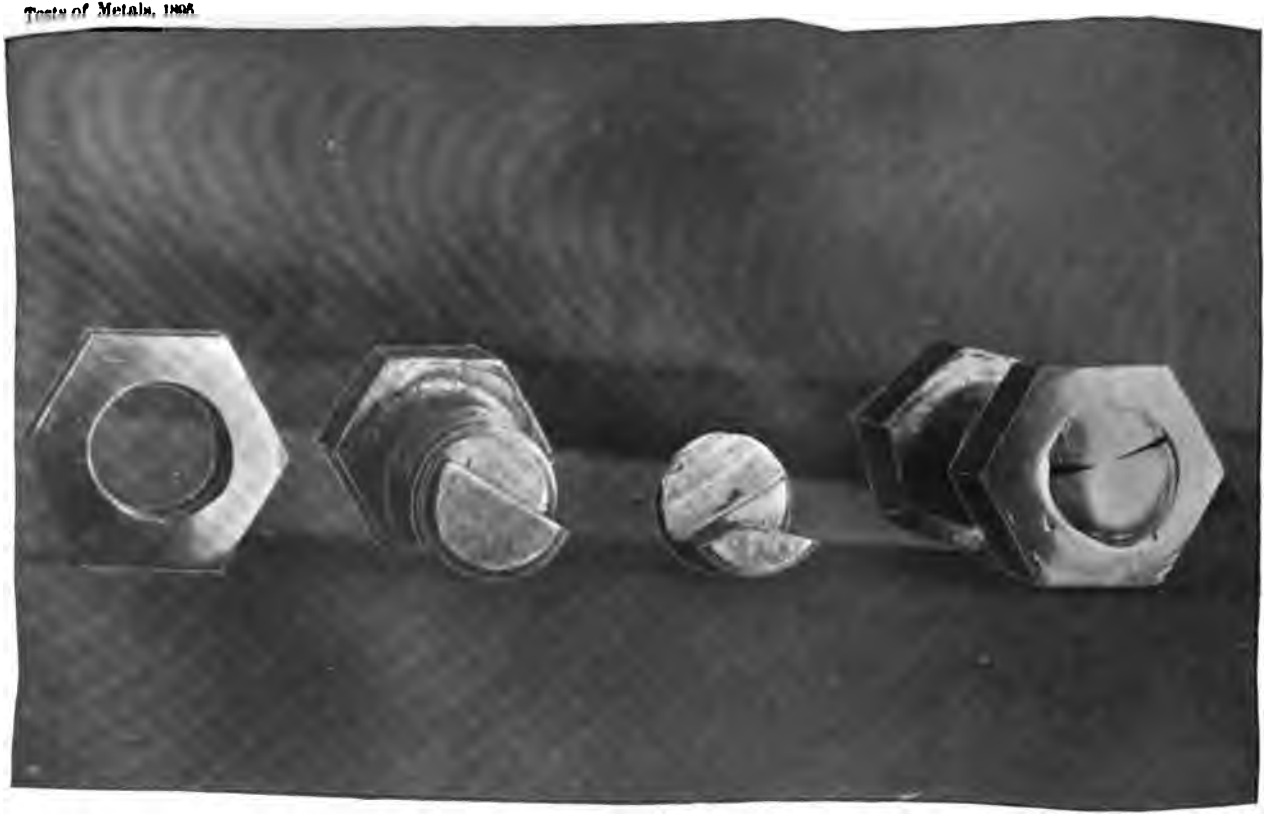
Sheared the rivets.

Maximum diameters of rivet holes after fracture: Inside row, 1".00; outside row, 1".17.

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	42,120
Tension on net section of plate	do	62,740
Compression on bearing surface of rivets	do	68,750
Shearing on rivets	do	40,010

"VIBRATION-PROOF" BOLTS AND NUTS.

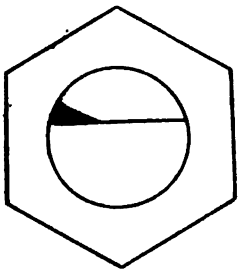


VIEW NO. 1.

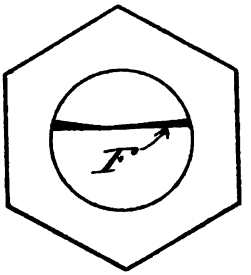
VIEW NO. 2.

End views of Nuts and Bolts.

Sketch a



Sketch b



THE HORNE PETERS CO PHOTO-LITHO. WASHINGTON D C

"VIBRATION-PROOF" BOLTS AND NUTS.

Two "vibration-proof" bolts and nuts were received for examination and tests, as shown on photograph No. 1.

One bolt, designated No. 1 for convenience of reference, had a locking segment ".40 long, while bolt No. 2 had a locking segment ".68 long over all, with a full section at its outer end and slotted to receive a screw-driver point.

The first test was made to observe the behavior of bolt No. 1 under the influence of vibratory effects. For this purpose a 15" shot was suspended from the head of the bolt, as shown on photograph No. 2. The body of the bolt passed through a clearance hole in a $\frac{7}{16}$" bar, and the nut with its locking segment was screwed on until the head of the nut was flush with the end of the bolt. The nut was then backed off with a wrench until the locking segment firmly engaged the nut and was apparently in position of maximum frictional resistance, as indicated by sketch *b*.

In this condition the $\frac{7}{16}$" supporting bar was hammered by rapid blows of a 1¼-pound hammer. After an interval of 40 seconds the locking segment had resumed the released position as indicated by sketch *a*, and the nut had also backed off an appreciable amount, which movement continued while the hammering continued. The bolt and nut was now in the condition of an ordinary bolt, the locking segment remaining inoperative.

A second test was made under similar conditions of loading. In this experiment, however, the locking segment was left in the position shown by sketch *a*, which it assumed as the nut was run on the bolt.

The $\frac{7}{16}$" bar was hammered as before and the nut gradually backed off while the locking segment remained in its so-called "natural position," there being no apparent tendency to work into an operative position when the nut was jarred off by the means here employed.

A third test was made in which the conditions of loading were as before; that is, the 15" shot was the load suspended from the bolt. In the present test, however, the tensile stress on the bolt was increased by placing a washer between the $\frac{7}{16}$" bar and the head of the bolt and the nut being firmly screwed down against the bar. The locking segment was driven into operation by means of a wedge placed at F, as shown on sketch *b*, without releasing the pressure of the nut against the $\frac{7}{16}$" bar.

While in service, provided the locking segment should follow the nut into an operative position, the backlash to be taken up before this was accomplished would measurably release the tension on the bolt, yet in this test, by wedging the locking segment into position, it was believed that rather more favorable conditions were introduced to develop the efficiency of the device than would be experienced with bolts in service.

In this test, however, the vibration caused by hammering the $\frac{7}{16}$" bar caused the nut to back off the bolt, and simultaneously the locking segment unlocked and returned to its natural position, as shown on sketch *a*.

The test of bolt No. 1, first described, was repeated with bolt No. 2, with the same results. The vibration tests were now discontinued, the results showing that conditions were not met under which the nuts were unaffected by vibration.

Observations were next made on the backlash, or how much recession of the nuts on the bolts is permitted before the locking segments become operative, when the nuts are backed off with a wrench.

The nut on bolt No. 1 was turned backward 14⅓ degrees, and that on bolt No. 2 15½ degrees before the locking segments interposed their resistance, hence the recessional movement of the nuts longitudinally on the bolts was about ".004 each, the bolts having 10 threads per inch.

Ascertaining the resistance of the nuts against backing off, measured on a radius of 1?", the nut on bolt No. 1 gave a maximum resistance of 75 pounds, which fell to 35 pounds as the backing-off movement continued. After working the nuts back and forth through an arc of about 60 degrees the maximum resistance was 35 pounds, which dropped to 15 pounds as the backing-off movement continued.

The resistance of the nut on bolt No. 2 ranged from 42 to 35 pounds.

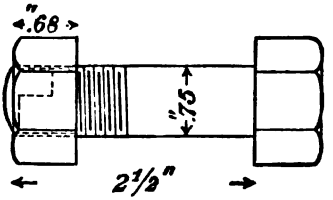
After making these observations the bolts were tested by tension, as follows:

TENSION TESTS OF "VIBRATION-PROOF" BOLTS AND NUTS.

Loads applied against nut and head of bolt.

No. 7832.

Wrought-iron bolt, No. 1.



Diameter at root of thread, ".63.

Ten threads per inch.

Length of locking segment, ".40.

Length of bolt cut away to receive locking segment, ".45.

Nut screwed on flush with end of bolt, engaging three full threads below locking-device recess.

Tensile strength, 17,240 pounds.

Appearance of fracture fibrous.

Ruptured bolt at face of nut in part, and in part stripped threads from the bolt. The threads were stripped on the side of the bolt having the locking-device recess.

No. 7832*a*.

Bolt retested with the nut run on the full threads beyond the locking device recess, and thus tested as an ordinary bolt.

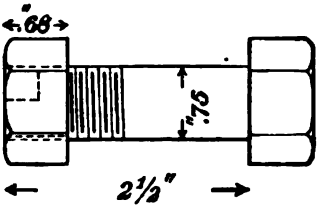
Tensile strength, 19,450 pounds.

Fibrous fracture, rupturing bolt at face of the nut

No. 7833.

Locking segment with full diameter slotted end.

Wrought-iron bolt No. 2.

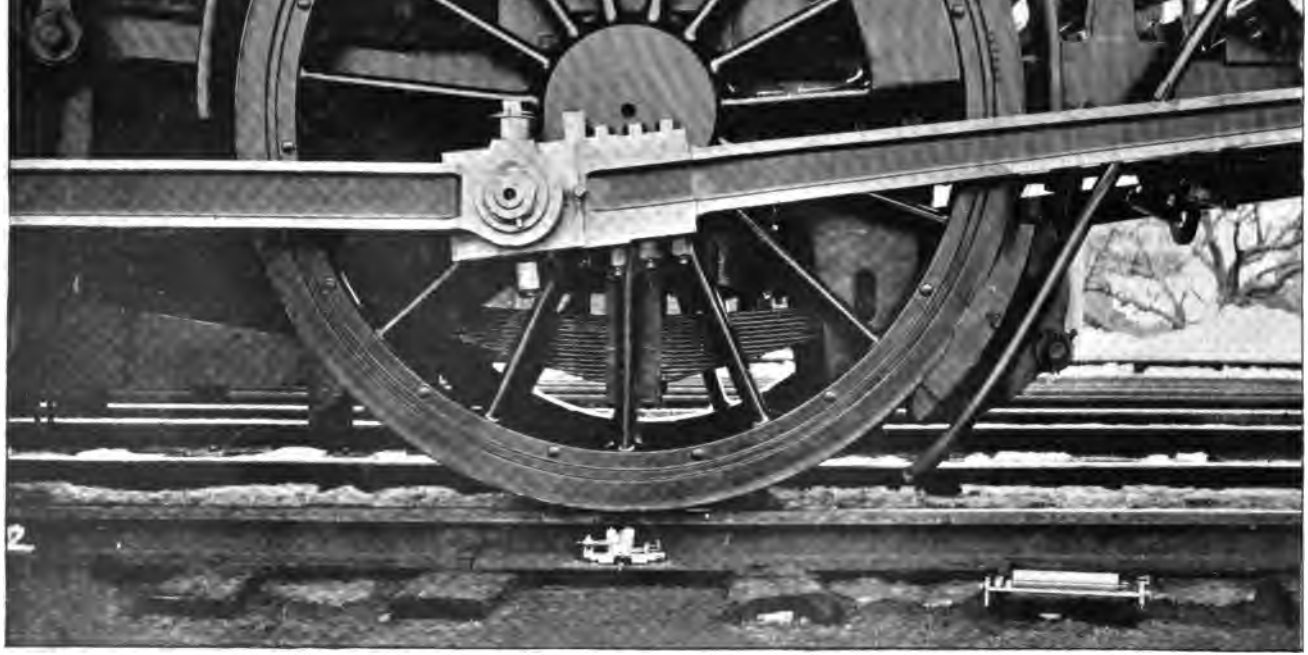


Diameter at root of thread, ".63.
Ten threads per inch.
Length of locking segment, ".68 over all.
Length of locking recess in bolt. ".46.
Nut screwed on beyond slotted end of locking segment, engaging one full thread on body of bolt.
Tensile strength, 14,020 pounds.
Appearance of fracture fibrous.
Ruptured bolt at face of nut in part, and stripped that part of the thread below the locking device recess.

No. 7833*a*.

Bolt retested with the nut run on the full threads beyond the locking recess, and thus tested as an ordinary bolt.
Tensile strength, 18,430 pounds.
Fibrous fracture, rupturing the bolt at the face of the nut.

RAILROAD TRACK EXPERIMENTS.



VIEW SHOWING MICROMETER FOR MEASURING STRAINS IN RAILS, IN POSITION ON BASE OF RAIL UNDER DRIVING WHEEL.

RAILROAD TRACK EXPERIMENTS.

These experiments comprise observations on the fiber stresses developed in rails in the track, the depression of the rails, and the slope or inclination of the rails caused by the weight of the different wheels of the locomotive.

The results show some of the phenomena displayed by rails in service under static conditions of loading or when a locomotive passes slowly over the track.

The tests will in a measure supplement laboratory experiments in this class of material, in addition to the aid which they may afford to practical questions pertaining to maintenance of way.

The series were made chiefly on the track of the Pennsylvania Railroad, where exceptional opportunities existed for examining roadbed, embracing a wide variety of conditions of weight of rails and different kinds of ballast and its behavior under heavy types of freight and passenger locomotives.

The tests were made during the early part of the month of November, 1894, on track in the condition it was found in service.

The experiments on the Boston and Albany Railroad were made, with track on frozen gravel ballast, in the month of February, 1895.

Describing the methods of making the experiments, the fiber stress tests were made by means of a micrometer mounted on the upper side of the outer flange of the base of the rail, at a place midway adjacent ties.

The instrument covered a gauged length of 5 inches.

The micrometer was adjusted in position, and then the several wheels of the locomotive were successively brought over the gauged length, or until the same was midway adjacent wheels.

The instrument was read when the locomotive was at each of these positions. It was found practicable to make the micrometer observations without arresting the locomotive in all cases, taking the readings as the locomotive passed slowly over the rail.

In this manner the strains developed were measured, an elongation of the metal showing tensile stress, and a contraction in the gauged length showing compressive stress.

The measured strains were reduced to stresses per square inch, assuming the modulus of elasticity of the steel to be 30,000,000 pounds per square inch, and correcting the observed strains in order to obtain the maximum fiber stresses, on the further assumption that the strains were proportional to their distances from the neutral axis of the rail.

The accompanying photograph shows the micrometer in position on the base of the rail, under the driving wheel of a locomotive.

The depression of the rails was measured by means of a sensitive level bubble mounted on a rod carrying at one end a screw micrometer, which rested upon a stake driven in the roadbed 30 inches from the rail; the other end of the rod rested upon the base of the rail.

The depression of the track was thus measured with reference to the top of the stake used as a bench mark.

In this series it was necessary to arrest the movement of the locomotive at each observation.

The slope tests or inclination of the rails were made by means of a sensitive level bubble mounted on a frame 12 inches long. At one end of the frame there was a fixed supporting rod having a conical point; at the other end there was a screw micrometer, the contact end of which was also made with a conical point.

In the use of this instrument two center-punch marks 12 inches apart were made on the base of the rail. The conical points of the instrument entered these center-punch marks and furnished definite contact points with the rail. The instrument was then leveled and the changes in slope, when the rail was affected by the locomotive, was measured from this initial adjustment of the level bubble.

The photograph shows the slope instrument resting on the second tie to the right of the fiber-stress micrometer. The rails examined ranged in weight from 60 to 100 pounds per yard, and were supported on oak ties resting on cinder, gravel, and stone ballast in the case of the Pennsylvania Railroad.

On the Boston and Albany Railroad, yellow-pine ties, with shoulder tie plates, were used, the roadbed being ballasted with gravel, which was in a frozen condition at the time of the tests.

The general dimensions are given in Table No. 1.

A heavy type of freight and passenger locomotive was employed, the weights of which are recorded in Table No. 2.

Referring to the tests on the Pennsylvania Railroad, the tensile fiber stresses developed under the weight of the driving wheels ranged from 2,810 to 19,540 pounds per square inch, and the compressive stresses, when the gauged length was between wheels, reached 7,880 pounds per square inch.

These values belonged to the rails in their ordinary condition of service. A tie was removed from the track, laid with rails 100 pounds to the yard, which increased the distance between centers of ties to 52 inches, and here the maximum tensile stress developed was 18,970 pounds per square inch against 9,840 pounds per square inch for another rail of the same section resting on ties 26 inches apart.

A splice bar on a 70-pound rail was strained to 22,140 pounds per square inch tension and 8,300 pounds per square inch compression stress by the drivers of passenger engine No. 809.

Table No. 3 shows the maximum tensile fiber stress caused by the wheels of the pilot, engine, and tender on the different rails and kinds of ballast, also the maximum compression stresses developed in each experiment.

These figures will be accepted as representing the range of fiber stresses expected in track which is in usual first-class condition and under the static loads here given.

The place of observation in these experiments was between ties and about one-quarter the length of the rail from the end.

From the irregular manner in which the stresses were developed in the different weights of rails, it is evident that the peculiar condition of the track at individual rails has an important influence on the magnitude of the fiber stresses.

The lightest section of rail examined, 60 pounds per yard, resting on ties on gravel ballast, gave exceptionally low fiber stresses, and it will be seen that this rail was depressed a correspondingly small amount.

So much variation is found in the stresses as to practically obscure the relative strengths of the different weights of rails, and it seems necessary to compare the extreme sections to show a well-defined difference in the maximum stresses.

Computations have been made to show the equivalent free spans of the rails corresponding to the measured stresses; that is, given the load and strain developed, then computing what the free span should be to account for the stress found. In these computations the rails are considered as supported at two places and loaded midway.

The results of these computations are given in Table No. 5, from which it appears that the equivalent span is found to have a value much lower than the distance from center to center of ties in some cases and a much greater value in others.

Those cases in which the equivalent span is greater than the distance from center to center of ties are shown in heavy-faced type, and are the ones generally caused by the outside wheels of the locomotive or wheels next a wide unloaded space on the rail.

A small instrumental error in measuring the strains necessarily leads to a large error in deducing the equivalent free span. The results derived, however, are believed to closely represent their true purported values.

So different are the computed spans based on the measured strains from the spacing of the ties, that it would evidently be impracticable to compute the fiber stresses in the rail from the data furnished by the dimensions of the rail, the spacing of the ties, and the load on the wheels, at least taking rails as they exist in ordinary track.

On account of the peculiar conditions influencing the behavior of the individual rails, the relative values of the different kinds of ballast are less conspicuously shown in the fiber-stress experiments than in the series on the depression of the rails.

The relative effects of the several wheels of the locomotives are shown with greater precision than some other features of the tests, inasmuch as in this comparison the action of all wheels are referred to the same point on the rail.

Table No. 4 shows the tensile stresses developed per ton weight on the different wheels of each locomotive on the several rails.

From these results, it appears that the stresses are generally greatest under the outside wheels, the same as remarked for the equivalent spans, these two sets of results being of course proportional to each other.

An examination of the results shows, as an extreme case, that the pilot wheel of freight engine No. 557 on a 60-pound rail, with stone ballast, gave a fiber stress of 4,058 pounds per square inch per ton on the wheel, whereas the first driver of the engine, per ton, strained the rail only 1,685 pounds per square inch.

In this instance the total stress per square inch was the same under these two wheels, namely 11,160 pounds, although the weight on the drivers was more than twice that on the pilot wheel.

Throughout this and earlier series of track experiments the same tendency has been found, the outside wheels exerting the most severe action on the rails in proportion to the weights which they carry.

The maximum and minimum tensile stresses per ton on the different wheels are shown in Table No. 5.

Illustrative of the influence which the condition of the roadbed has on the fiber stresses, the 60-pound rail on gravel ballast showed 1,247 pounds per square inch stress per ton under the pilot wheel of the engine, whereas, with the same weight of rail on stone ballast, the same wheel gave 4,058 pounds per square inch.

On the 100-pound rail, with stone ballast, the same pilot wheel per ton developed 1,276 pounds per square inch tensile stress.

With relation to the effects of the two classes of locomotives, on some rails the stresses were less for the passenger drivers per ton than for the drivers of the freight engine. On other rails the effects were reversed, and again the two classes gave substantially the same results on certain other rails.

This balancing of results, so far as shown by the present experiments, indicates no decided difference per ton on the wheels between the freight and passenger drivers.

It is probable that the weight on one driver more or less influences the effects on the rail of the other drivers of the same engine, and the spacing of the ties and tamping of the ballast might at times favor one engine or the other, accounting in a measure for the variable results and tending to explain why the maximum and minimum effects are found under different wheels in different experiments.

The fiber-stress experiments on the Boston and Albany Railroad were made on rails 95 pounds per yard, on frozen gravel ballast, and observations were taken at several points along the length of the rails.

The observations on rail No. 1 were made with the rail in the condition in which it was found in the track. There was some looseness between the tie plates and the rail and ties, which in rail No. 2 was diminished as far as possible by redriving the spikes and by the use of a number of additional ones.

This is the only instance in which spikes were redriven before testing.

Rail No. 1 was examined at two, and No. 2 was examined at seven places along its length.

The tensile fiber stresses at the first end of rail No. 2 were higher than those developed at the middle and near the second end of the rail.

In this rail, as the tensile stresses diminished at the second end the compressive stresses increased. At the space M, 33 inches from the end of the rail, the compressive stress in the base reached 7,630 pounds per square inch when this space was midway the drivers. The same stress was also shown when the space was between the tender trucks.

Concerning the relation between the fiber stress developed and the total depression of the rail, the evidence generally favors the deduction that diminished depression will be accompanied by diminished fiber stress.

The diagrams representing the depression of the rails examined on the Pennsylvania Railroad show with the 60-pound rails the least depression on the gravel ballast, the order of rigidity being gravel, stone, and cinder ballast. With the 70-pound sections the order of rigidity is gravel, cinder, and stone ballast.

Under the 85-pound rails the stone ballast gave greater rigidity than the gravel. No test for depression was made with cinder ballast under the 85-pound rails, and only stone ballast was used under the 100-pound rails.

Table No. 7 states the mean depression of the driving wheels, and also the mean depression of all the other wheels of the locomotive in each experiment. There is in the table a column of differences, which states the excess of depression of the drivers over that of the other wheels.

The column of differences is useful in showing the additional depression of the rails under the weights of the driving wheels after they have been loaded by the other wheels. The rails which displayed the greatest depression were somewhat loosely floated by the ballast, but it does not appear that the rail in any case was bronght to a condition of extreme rigidity by the pilot and tender wheels, the greater weight of the drivers causing additional depression.

Under the 60 and 70 pound sections the gravel ballast gave the greatest rigidity under the drivers as well as under the other wheels, and in the column of differences the excess of depression was least for this kind of ballast.

The total depression with the 85-pound rails was less for the stone than for the gravel ballast, although the excess of depression under the drivers was practically the same in the two cases.

The depression of the rails on frozen gravel ballast, in which there was no visible movement of the ties, would seem to represent about the attainable limit of rigidity in track on wooden ties.

A comparison, however, of rails Nos. 1 and 2 on the Boston and Albany Railroad shows that under working conditions rail No. 1 was not in so rigid a condition as it was practicable to put the other rail by redriving the spikes.

The fact that the 60-pound rail on gravel compares favorably with the heavier section on the frozen ballast indicates that this light section of rail was in a condition approaching maximum rigidity.

Diagrams Nos. 32 to 36, inclusive, show the results of the slope tests.

The instrument employed covered a length of 12 inches on the outer flange of the base of the rail, hence the figures given refer to the difference in level on a chord of 12 inches.

The approach of the locomotive was felt for a distance of 12 to 15 feet in front of the first wheel. The first observed movement was an upward one, the inclination of the rail sloping in a direction from the locomotive. This was followed by a reversal in the direction of the inclination, which then sloped toward the locomotive.

As the several wheels successively passed over the place of observation the inclination of the slope reached a maximum and was reversed in direction, these motions being repeated under each wheel with some modifications, according to the condition of the track.

After the locomotive had passed over the place of observation the inclination gradually diminished, and eventually the rail practically resumed its original level. A very critical examination led to the conclusion that each passage of a locomotive left the rail in a slightly different state than it before occupied, and that some sluggishness of recovery in the ballast had an influence on these minute displacements.

TABLE NO. 1.—*Railroad track experiments—general dimensions of rails.*

Weight per yard.	Height.	Width of base.	Width of head.	Thickness of web.	Moment of inertia I.	Moment of resistance $R = \frac{I}{n'}$	Distance, neutral axis to outside fiber.	
							Head n.	Base n'
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inch.*			*Inches.*	*Inches.*
60	4½	4½	2⅜	½	14.222	6.693	2.125	2.125
70	4⅝	4⅝	2⅞	½	18.055	8.282	2.32	2.18
85	5	5	2⅝	9/16	26.374	10.853	2.57	2.43
100	5⅛	5⅛	2⅛	⅝	38.957	14.812	2.87	2.63
95	5 3/32	5⅛	3	⅝	32.28	13.563	2.65	2.38

TABLE NO. 2.—*Weights of locomotives.*

Locomotive.	Total.	Engine.		Tender.	Weight per wheel.		
		Pilot.	Drivers.		Wheel.	Pounds.	Tons.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*			
Passenger, No. 809, class Pk.	197,050	39,750	87,300	70,000	Pilot	9,937	4.968
					Driver, first	21,750	10.875
					Driver, second	21,900	10.950
					Tender	8,750	4.375
Passenger, No. 1515, class T.	222,500	50,300	95,200	77,000	Pilot	12,575	6.287
					Driver, first	24,250	12.125
					Driver, second	23,350	11.675
					Tender	12,833	6.416
Freight, No. 557, class R.	188,600	11,000	113,800	63,800	Pilot	5,500	2.750
					Driver, first	13,250	6.625
					Driver, second	13,750	6.875
					Driver, third	15,650	7.825
					Driver, fourth	14,250	7.125
					Tender	7,975	3.987
Passenger, No. 209, B. and A. R. R.	199,700	40,700	75,000	84,000	Pilot	10,175	5.087
					Driver, first	18,750	9.375
					Driver, second	18,750	9.375
					Tender		
					First truck	9,250	4.625
					Second truck	11,750	5.875

TABLE NO. 3.—*Maximum fiber stresses in base of rail.*

Rail, weight per yard.	Ballast.	Locomotive.	Tensile fiber stress per square inch.			Compressive fiber stress per square inch.
			Pilot.	Drivers.	Tender.	
Pounds.			*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
60	Gravel	Passenger, No. 809, class Pk	6,180	11,670	2,750	1,370
60	do	Freight, No. 557, class R	3,430	7,550	3,430	690
60	Stone	Passenger, No. 809, class Pk	11,860	19,540	9,770	3,490
60	do	Freight, No. 557, class R	11,160	16,050	9,770	1,400
70	Cinder	Passenger, No. 809, class Pk	10,730	17,170	10,020	4,290
70	Gravel	do	8,970	18,620	8,280	5,520
70	do	Freight, No. 557, class R	7,590	13,790	6,210	4,830
70	Stone	Passenger, No. 809, class Pk	10,070	14,390	7,910	6,470
70	do	Freight, No. 557, class R	6,470	11,510	6,470	2,880
70	Bridge	Passenger, No. 809, class Pk	9,450	18,180	10,910	2,180
70	Splice bar	do	13,840	22,140	9,230	8,300
85	Cinder	Passenger, No. 809, class Pk	7,160	10,030	5,020	3,580
85	do	Passenger, No. 1515, class T	5,730	12,180	7,880	4,300
85	do	Freight, No. 557, class R	3,580	10,030	5,020	4,300
85	Gravel	Passenger, No. 809, class Pk	10,750	12,180	6,450	4,300
85	do	Passenger, No. 1515, class T	9,310	17,120	9,310	5,020
85	do	Freight, No. 557, class R	7,160	10,030	2,870	7,880
85	Stone	Passenger, No. 809, class Pk	7,160	10,750	4,300	4,300
85	do	Freight, No. 557, class R	4,300	10,030	5,020	3,580
100	do	Passenger, No. 809, class Pk	6,320	9,840	5,620	4,220
100	Stone, tie removed.	do	10,540	18,970	8,430	2,110
100	Stone	Freight, No. 557, class R	3,510	8,430	4,220	2,810
95	Frozen gravel, rail No. 1.	Passenger, No. 209, B. and A. R. R.	6,870	9,920	6,870	3,050
95	Frozen gravel, rail No. 2.	do	7,630	11,450	6,870	*a* 7,630

a Taken at different point on the rail.

TABLE NO. 4.—*Tensile fiber stresses in bases of rails per ton weight on the different wheels.*

PASSENGER LOCOMOTIVES.

Rail, weight per yard.	Locomotive.	Ballast.	Tensile fiber stress per ton weight on wheels of—							
			Pilot.		Drivers.		Tender.			
			First.	Second.	First.	Second.	First.	Second.	Third.	Fourth.
Lbs.			*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
70	No. 809, class Pk.	Cinder	2,160	2,017	1,578	1,568	1,799	1,799	1,634	2,290
85	do	do	1,441	721	949	916	1,147	656	656	983
85	No. 1515, class T.	do	911	911	945	1,043	1,228	782	1,116	.....
60	No. 809, class Pk.	Gravel	1,244	829	1,073	949	471	629	629	629
70	do	do	1,805	1,205	1,585	1,700	1,262	1,735	1,262	1,893
85	do	do	2,164	866	1,054	1,112	1,474	1,474	1,147	1,474
85	No. 1515, class T.	do	1,481	911	1,359	1,466	893	1,116	1,451	.....
60	No. 809, class Pk.	Stone	2,387	2,387	1,798	1,784	1,595	1,913	1,595	2,279
70	do	do	2,027	1,157	1,323	1,314	1,152	1,152	1,152	1,808
85	do	do	1,441	866	989	785	983	818	818	983
100	do	do	1,272	566	905	899	642	642	642	1,285
100	do	Stone, tie removed.	2,122	1,415	1,422	1,732	1,607	1,607	1,285	1,927
70	do	Bridge	1,468	1,902	1,672	1,328	2,327	1,995	1,995	2,494
70	do	Splice bar	2,786	2,228	1,697	2,022	1,897	1,477	1,687	2,110
95 D	No. 209, B. and A. R. R.	Frozen gravel, rail No. 1.	1,199	900	733	977	659	978	909	1,169
95 L	do	do	1,351	1,050	977	1,058	826	826	1,038	1,169
95 B	do	Frozen gravel, rail No. 2.	1,500	1,351	1,139	1,221	990	1,485	909	909
95 D	do	do	1,351	1,050	1,025	1,221	1,319	1,485	1,038	1,038
95 H	do	do	1,500	1,050	814	1,139	1,155	1,155	909	1,038
95 K	do	do	1,500	1,050	895	1,025	1,155	1,155	1,160	1,038
95 L	do	do	900	301	429	570	331	0	0	519
95 M	do	do	1,050	149	408	651	331	—164	129	260
95 N	do	do	751	600	651	733	659	495	519	650

FREIGHT LOCOMOTIVE.

Rail, weight per yard.	Locomotive.	Ballast.	Tensile fiber stress per ton weight on wheels of—								
			Pilot.	Drivers.				Tender.			
				First.	Second.	Third.	Fourth.	First.	Second.	Third.	Fourth.
Lbs.			*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
85	No. 557, class R.	Cinder	1,302	540	1,041	366	1,408	898	898	720	1,259
60	do	Gravel	1,247	518	999	878	1,060	860	617	860	860
70	do	do	2,760	1,250	1,805	1,323	2,512	1,558	1,384	1,038	1,384
85	do	do	2,604	974	1,146	824	1,408	720	720	359	720
60	do	Stone	4,058	1,685	2,335	1,872	2,056	2,450	1,926	2,275	2,450
70	do	do	2,353	761	1,046	1,011	1,615	1,264	1,084	903	1,622
85	do	do	1,564	865	1,041	732	1,408	1,078	898	898	1,259
100	do	do	1,276	424	511	718	1,183	705	880	351	1,058

TABLE NO. 5.—*Maximum and minimum tensile stresses per ton on the different wheels.*

Rail, weight per yard.	Ballast.	Locomotive.	Maximum stress.		Minimum stress.	
			Wheel.	Per square inch.	Wheel.	Per square inch.
Lbs.				*Pounds.*		*Pounds.*
60	Gravel....	Passenger, No. 809, class Pk.	First pilot.....	1,244	First tender..	471
60	.....do	Freight, No. 557, class R.	Pilot.....	1,247	First driver...	518
60	Stone.....	Passenger, No. 809, class Pk.	.....do	2,387	Third tender..	1,595
60	.....do	Freight, No. 557, class R.	.....do	4,058	First driver...	1,685
70	Cinder....	Passenger, No. 809, class Pk.	Fourth tender.	2,290	Second driver.	1,568
70	Gravel....	.....do	.....do	1,893	First tender..	1,262
70	.....do....	Freight, No. 557, class R.	Pilot.....	2,760	Third tender..	1,038
70	Stone.....	Passenger, No. 809, class Pk.	First pilot.....	2,027	First, second, and third tender.	1,152
70	.....do	Freight, No. 557, class R.	Pilot.....	2,353	First driver...	761
70	Bridge....	Passenger, No. 809, class Pk.	Fourth tender.	2,494	Second driver.	1,328
70	Splice bar.	.....do	First pilot.....	2,789	Second tender.	1,477
85	Cinder....	.....do	.....do	1,441	Second and third tender.	654
85	.....do	Passenger, No. 1515, class T.	First tender...	1,228	Second pilot..	782
85	.....do	Freight, No. 557, class R.	Fourth driver.	1,408	First driver...	540
85	Gravel....	Passenger, No. 809, class Pk.	First pilot.....	2,164	Second pilot..	866
85	.....do	Passenger, No. 1515, class T.	.....do	1,481	First tender..	893
85	.....do	Freight, No. 557, class R.	Pilot.....	2,604	Third tender..	359
85	Stone.....	Passenger, No. 809, class Pk.	First pilot.....	1,441	Second and third tender.	818
85	.....do	Freight, No. 557, class R.	Pilot.....	1,564	Third driver..	732
100	.....do	Passenger, No. 809, class Pk.	First pilot.....	1,272	Second pilot..	566
100	Stone, tie removed.	.....do	.....do	2,122	Third tender..	1,285
100	Stone.....	Freight, No. 557, class R	Pilot.....	1,276	.....do	451
95	Frozen gravel, rail No. 1.	Passenger, No. 209, B. and A. R. R.	First pilot.....	1,199	First driver...	733
			.....do	1,351	First tender..	826
			.....do	1,500	Third and fourth tender.	909
			Second tender.	1,485	First driver...	1,025
95	Frozen gravel, rail No. 2.	.....do	First pilot.....	1,500	.....do	814
			.....do	1,500	.....do	895
			.....do	900	Second and third tender.	0
			.....do	1,050	Second tender.	−164
			.....do	751	.....do	495

TABLE No. 6.—*Equivalent span corresponding to observed fiber stresses—Rail considered as a beam supported at two bearings and loaded at the middle.*

PASSENGER LOCOMOTIVES.

Rail, weight per yard.	Locomotive.	Ballast.	Distance center to center of ties.	Equivalent span.							
				Pilot.		Drivers.		Tender wheels.			
				First.	Second.	First.	Second.	First.	Second.	Third.	Fourth.
Lbs.			*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*
70	No. 809, class Pk.	Cinder	24	35.8	33.4	26.1	26.0	29.8	29.8	27.1	37.9
85	do	do	26	31.3	15.6	20.0	19.9	24.9	14.2	14.2	21.3
85	No. 1515, class T.	do	26	19.8	19.8	20.5	22.6	26.7	17.0	24.2	.....
60	No. 809, class Pk.	Gravel	24	16.6	11.1	14.4	12.6	6.3	8.4	8.4	8.4
70	do	do	24	29.9	29.9	26.3	28.2	20.9	28.7	20.9	31.4
85	do	do	25	47.0	18.8	22.9	24.1	32.0	32.0	24.9	32.0
85	No. 1515, class T.	do	25	32.1	19.8	29.5	31.8	19.4	24.2	31.5	.....
60	No. 809, class Pk.	Stone	24	31.9	31.9	24.0	23.9	21.4	25.6	21.4	29.9
70	do	do	23	33.6	19.2	21.9	21.8	19.1	19.1	19.1	29.9
85	do	do	26	31.3	18.8	21.5	17.0	21.3	17.8	17.8	21.3
90	do	do	26	37.7	16.8	26.8	26.6	19.0	19.0	19.0	38.0
100	do	do	a52	62.8	41.9	42.1	51.3	47.6	47.6	38.0	57.1
70	do	Bridge	21	24.2	31.5	27.6	21.9	38.5	38.0	38.0	41.3
85	No. 209, B. and A. R. R.	Rail No. 1, frozen gravel.	D 24	32.5	24.4	19.9	26.5	17.9	26.4	24.7	31.7
		do	L 32	36.6	28.5	26.5	28.7	22.4	22.4	28.2	31.7
85	do	Rail No. 2, frozen gravel.	B 24	40.7	36.6	30.9	33.1	26.9	40.3	24.7	24.7
		do	H 26	40.7	28.5	22.1	30.9	31.3	31.3	24.7	28.2
		do	K 24	40.7	28.5	24.3	26.5	31.3	31.3	31.7	28.2
		do	M 22	28.5	4.1	11.2	17.6	9.0	4.5	3.5	7.1

a Tie removed.

FREIGHT LOCOMOTIVE.

Rail, weight per yard.	Locomotive.	Ballast.	Distance center to center of ties.	Equivalent span.							
				Pilot.	Driver.				Tender wheels.			
					First.	Second.	Third.	Fourth.	First.	Second.	Third.	Fourth.
Lbs.			*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*
85	No. 557, class R.	Cinder	26	28.3	11.7	22.6	8.0	30.6	19.5	19.5	15.6	27.3
60	do	Gravel	24	16.7	6.9	13.4	11.7	14.2	11.5	6.9	11.6	11.6
70	do	do	24	45.7	20.7	29.9	21.9	32.1	25.8	22.9	17.2	22.9
85	do	do	25	56.5	21.1	24.9	17.9	30.6	15.6	15.6	7.8	15.6
60	do	Stone	24	54.3	22.6	31.3	25.1	27.5	32.8	25.8	30.4	32.8
70	do	do	23	39.0	12.6	17.3	16.7	26.8	20.9	17.9	14.9	26.9
85	do	do	26	33.9	18.8	22.6	15.9	30.6	23.4	19.5	19.5	27.3
100	do	do	26	37.8	12.6	15.1	21.3	35.0	20.9	26.1	10.4	31.4

Equivalent span computed by the formula $l = \frac{4SI}{Pv}$.

S = fiber stress.
I = moment of inertia.
P = load in pounds.
v = distance from neutral axis to most remote fiber in base.

TABLE NO. 7.—*Depression of rails.*

Mean depression under the driving wheels, and mean depression under the pilot and tender wheels.

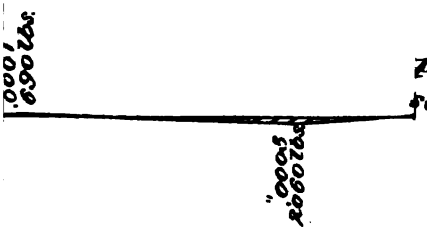
Rail, weight per yard.	Ballast.	Locomotive.	Drivers.	Pilot and tender.	Difference.
Pounds.			*Inch.*	*Inch.*	*Inch.*
60	Cinder	Passenger, No. 809, class Pk	.229	.154	.075
60	Gravel	do	.073	.042	.031
60	Stone	do	.162	.122	.040
70	Cinder	do	.230	.157	.073
70	Gravel	do	.138	.089	.049
70	Stone	do	.277	.207	.070
85	Gravel	do	.233	.184	.049
85	Stone	do	.144	.097	.047
100	do	do	.168	.116	.052
95	Frozen gravel, rail No. 1.	Passenger, No. 209, B. and A. R. R.	.139	.103	.036
95	Frozen gravel, rail No. 2, spikes redriven.	do	H .069 K .085 N .069	.039 .059 .046	.030 .026 .023

Railroad Track Experiments.

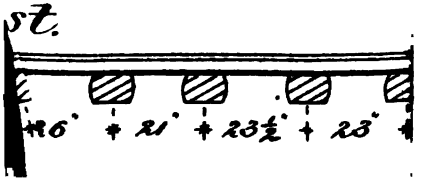
LIST OF DIAGRAMS.

No. of diagram.	Locomotive.	Test.	Rail, weight per yard.	Ballast.
			Pounds.	
1	Passenger, No. 809, class Pk	Fiber stress	60	Gravel.
2	Freight, No. 557, class R	do	60	Do.
3	Passenger, No. 809, class Pk	do	60	Stone.
4	Freight, No. 557, class R	do	60	Do.
5	Passenger, No. 809, class Pk	do	70	Cinder.
6	do	do	70	Gravel.
7	Freight, No. 557, class R	do	70	Do.
8	Passenger, No. 809, class Pk	do	70	Stone.
9	Freight, No. 557, class R	do	70	Do.
10	Passenger, No. 809, class Pk	do	70	Bridge.
11	do	do	(a)	
12	do	do	85	Cinder.
13	Passenger, No. 1515, class T	do	85	Do.
14	Freight, No. 557, class R	do	85	Do.
15	Passenger, No. 809, class Pk	do	85	Gravel.
16	Passenger, No. 1515, class T	do	85	Do.
17	Freight, No. 557, class R	do	85	Do.
18	Passenger, No. 809, class Pk	do	85	Stone.
19	Freight, No. 557, class R	do	85	Do.
20	Passenger, No. 809, class Pk	do	100	Do.
21	do	Fiber stress with tie removed.	100	Do.
22	Freight, No. 557, class R	Fiber stress	100	Do.
23	Passenger, No. 809, class Pk	Depression	60	Cinder.
24	do	do	60	Gravel.
25	do	do	60	Stone.
26	do	do	70	Cinder.
27	do	do	70	Gravel.
28	do	do	70	Stone.
29	do	do	85	Gravel.
30	do	do	85	Stone.
31	do	do	100	Do.
32	do	Slope	70	Gravel.
33	do	do	85	Stone.
34	Passenger, No. 1515, class T	do	85	Cinder.
35	Freight, No. 557, class R	do	85	Stone.
36	do	do	100	Do.
37	Passenger, No. 809, class Pk	Depression	60	Cinder, gravel, and stone.
38	do	do	70	Do.
39	do	Fiber stress	60 70 85	Gravel. Do. Do.
40	do	do	60 70 85 100	Stone. Do. Do. Do.
41	Freight, No. 557, class R	do	60 70 85 100	Do. Do. Do. Do.
42	Passenger, No. 209	Depression	b 95	Frozen gravel.
43	do	Fiber stress	b 95	Do.
44	do	Depression	c 95	Do.
45	do	Fiber stress	c 95	Do.

a Seventy-pound rail No. 4, angle splice. b No. 1. c No. 2.



pressive strains and
ses per sq. inch.



surements taken on

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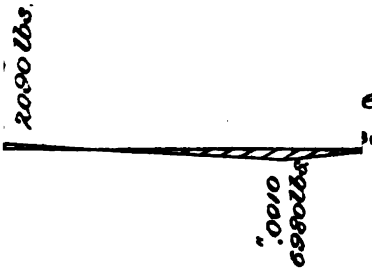
depression with the 85-pound rails was less for the stone
gravel ballast, although the excess of depression under
was practically the same in the two cases.
ession of the rails on frozen gravel ballast, in which there
ble movement of the ties, would seem to represent about
le limit of rigidity in track on wooden ties.
son, however, of rails Nos. 1 and 2 on the Boston and Albany
ows that under working conditions rail No. 1 was not in so
ition as it was practicable to put the other rail by redriving

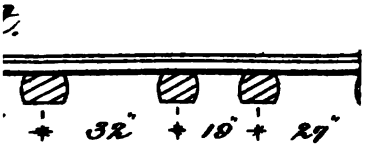
that the 60-pound rail on gravel compares favorably with
section on the frozen ballast indicates that this light sec-
was in a condition approaching maximum rigidity.
Nos. 32 to 36, inclusive, show the results of the slope tests.
ument employed covered a length of 12 inches on the outer
e base of the rail, hence the figures given refer to the dif-
vel on a chord of 12 inches.
each of the locomotive was felt for a distance of 12 to 15
of the first wheel. The first observed movement was an
the inclination of the rail sloping in a direction from the
This was followed by a reversal in the direction of the incli-
h then sloped toward the locomotive.
veral wheels successively passed over the place of observa-
ination of the slope reached a maximum and was reversed
these motions being repeated under each wheel with some
s, according to the condition of the track.
locomotive had passed over the place of observation the
gradually diminished, and eventually the rail practically re-
iginal level. A very critical examination led to the conclu-
h passage of a locomotive left the rail in a slightly different
before occupied, and that some sluggishness of recovery
t had an influence on these minute displacements.

No. 1.—*Railroad track experiments—general dimensions of rails.*

Height.	Width of base.	Width of head.	Thickness of web.	Moment of inertia I.	Moment of resistance $R=\frac{I}{n'}$	Distance, neutral axis to outside fiber.	
						Head n.	Base n'
Inches.	*Inches.*	*Inches.*	*Inch.*			*Inches.*	*Inches.*
4½	4½	2⅜	¼	14.222	6.693	2.125	2.125
4⅝	4⅝	2 7/16	¼	18.055	8.282	2.32	2.18
5	5	2⅝	11/32	26.374	10.853	2.57	2.43
5½	5½	2⅞	⅜	38.957	14.812	2.87	2.63
5 9/16	5⅝	3	⅜	32.28	13.563	2.65	2.38



essive strains, and
s per sq. inch.



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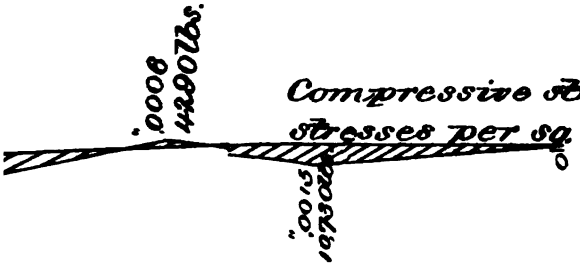
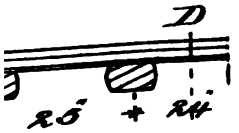


Compressive strains, and stresses per sq. inch.



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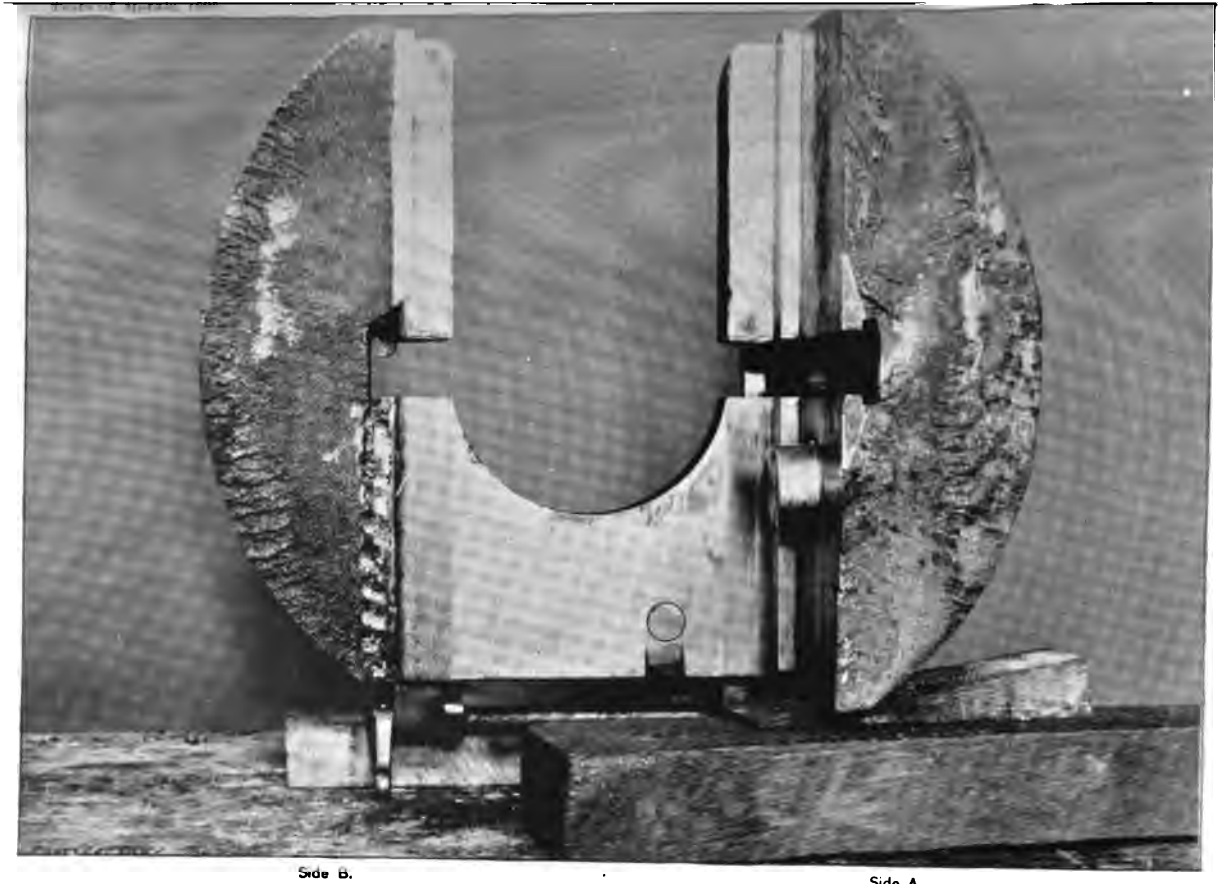
HOTCHKISS 4″.7 RAPID-FIRE GUN.

SPECIMENS FROM EXPLODED BREECH.



Side B. Side A.

BREECH FRAGMENT.

HOTCHKISS 4″.7 RAPID-FIRE GUN.

No. 5308.

Longitudinal side, A.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000200	.000133	.....	.....	
5,000	20,000	.000400	.000200	0.	.....	
6,250	25,000	.000567	.000167	.....	.....	
7,500	30,000	.000833	.000266	0.	.....	
8,750	35,000	.001067	.000234	.....	.....	
10,000	40,000	.001200	.000133	0.	.....	
10,250	41,000	.001233	.000033	.....	.....	
10,500	42,000	.001300	.000067	.....	.....	
10,750	43,000	.001367	.000067	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	Elastic limit.
		.005000	.003567	.....	.....	
11,500	46,000	.005967	.000967	.....	.....	
11,750	47,000	.006600	.000633	.....	.....	
12,000	48,000	.007333	.000733	.....	.....	
12,250	49,000	.008067	.000734	.....	.....	
12,500	50,000	.009000	.000933	.....	.....	
13,000	52,000	.010667	.001667	.....	.....	
13,500	54,000	.012333	.001666	.....	.....	
14,000	56,000	.014167	.001834	.....	.....	
14,500	58,000	.016000	.001833	.....	.....	
15,000	60,000	.018167	.002167	.....	.....	
15,500	62,000	.020667	.002500	.....	.....	
16,000	64,000	.022667	.002000	.....	.....	
16,500	66,000	.025333	.002666	.....	.....	
17,000	68,000	.027667	.002334	.....	.....	
17,500	70,000	.031000	.003333	.....	.....	
18,000	72,000	.033667	.002667	.....	.....	
18,500	74,000	.037000	.003333	.....	.....	
19,000	76,000	.041667	.004667	.....	.....	
19,500	78,000	.046333	.004666	.....	.....	
20,000	80,000	.052667	.006334	.....	.....	
21,000	84,000	.0700	.017333	.....	.....	
22,000	88,000	.0967	.0267	.....	.....	
22,420	89,680	.1500	.0533	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,680
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.001433
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.29 from neck
Character of broken surface		silky
Elongation of inch sections		″.29, ″.27, ″.13

No. 5309.

Tangential side, A.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	0.	.....	
8,750	35,000	.001133	.000133	.....	.....	
10,000	40,000	.001367	.000234	.000033	.000033	
10,250	41,000	.001400	.000033	.....	.....	
10,500	42,000	.001433	.000033	.....	.....	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001500	.000033	.....	.....	Elastic limit.
11,250	45,000	.001633	.000133	.....	.....	
11,500	46,000	.002033	.000400	.....	.....	
11,750	47,000	.002667	.000634	.....	.....	
12,000	48,000	.004167	.001500	.....	.....	
12,250	49,000	.004733	.000566	.....	.....	
12,500	50,000	.005333	.000600	.....	.....	
13,000	52,000	.006733	.001400	.....	.....	
13,500	54,000	.008000	.001267	.....	.....	
14,000	56,000	.009433	.001433	.....	.....	
14,500	58,000	.010967	.001534	.....	.....	
15,000	60,000	.012667	.001700	.....	.....	
15,500	62,000	.014167	.001500	.....	.....	
16,000	64,000	.016167	.002000	.....	.....	
16,500	66,000	.018000	.001833	.....	.....	
17,000	68,000	.020467	.002467	.....	.....	
17,500	70,000	.022100	.001833	.....	.....	
18,000	72,000	.024333	.002233	.....	.....	
18,500	74,000	.027000	.002667	.....	.....	
19,000	76,000	.029667	.002667	.....	.....	
19,500	78,000	.032167	.002500	.....	.....	
20,000	80,000	.035667	.003500	.....	.....	
21,000	84,000	.0467	.011033	.....	.....	
22,000	88,000	.0567	.0100	.....	.....	
22,500	90,000	.0633	.0066	.....	.....	
23,000	92,000	.0733	.0100	.....	.....	
23,500	94,000	.0900	.0167	.....	.....	
23,860	95,440	.1233	.0333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,440
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.1453
Elongation per inch under strain at elastic limit	do...	.001500
Reduction in diameter at point of rupture	do...	.064
Reduction in area after rupture, per cent of original section		21.4
Position of rupture		″.80 from neck
Character of broken surface		granular; radiating from a small dull spot in the circumference. Surface cracks developed in the vicinity of the place of rupture.
Elongation of inch sections		″.08, ″.13, ″.22

No. 5310.

Longitudinal side, B.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000067	.000067	0.	.....	
2,000	10,000	.000267	.000200	.....	.....	
4,000	20,000	.000433	.000166	.....	.....	
6,000	30,000	.000700	.000267	0.	.....	
7,000	35,000	.000867	.000167	.....	.....	
8,000	40,000	.000967	.000100	0.	.....	
8,200	41,000	.001000	.000033	.....	.....	
8,400	42,000	.001000	0.	.....	.....	
8,600	43,000	.001033	.000033	.....	.....	
8,800	44,000	.001067	.000034	.....	.....	Elastic limit.
9,000	45,000	.002667	.001600	.....	.....	
9,200	46,000	.003867	.001200	.....	.....	
9,400	47,000	.004067	.000200	.....	.....	
9,600	48,000	.004667	.000600	.....	.....	
9,800	49,000	.005033	.000366	.....	.....	
10,000	50,000	.005600	.000567	.....	.....	
10,400	52,000	.006667	.001067	.....	.....	
10,800	54,000	.007667	.001000	.....	.....	
11,200	56,000	.008833	.001166	.....	.....	
11,600	58,000	.010000	.001167	.....	.....	
12,000	60,000	.011367	.001367	.....	.....	
12,400	62,000	.012600	.001267	.....	.....	
12,800	64,000	.014167	.001567	.....	.....	
13,200	66,000	.015800	.001633	.....	.....	
13,600	68,000	.017500	.001700	.....	.....	
14,000	70,000	.019333	.001833	.....	.....	
14,400	72,000	.021200	.001867	.....	.....	
14,800	74,000	.023500	.002300	.....	.....	
15,200	76,000	.026000	.002500	.....	.....	
15,600	78,000	.028667	.002667	.....	.....	
16,000	80,000	.031667	.003000	.....	.....	
16,800	84,000	.0433	.011633	.....	.....	
17,600	88,000	.0567	.0134	.....	.....	
18,000	90,000	.0733	.0166	.....	.....	
18,190	90,950	.1000	.0267	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,950
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.1700
Elongation per inch under strain at elastic limit	do...	.001067
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section	do...	43.3
Position of rupture		″.95 from neck
Character of broken surface		silky
Elongation of inch sections		″.18, ″.38

No. 5311.

Tangential side, B.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.		
2,500	10,000	.000267	.000200			
5,000	20,000	.000567	.000300	0.		
7,500	30,000	.000933	.000366	0.		
8,750	35,000	.001067	.000134			
10,000	40,000	.001267	.000200	0.		
10,250	41,000	.001300	.000033			
10,500	42,000	.001333	.000033			
10,750	43,000	.001367	.000034			
11,000	44,000	.001400	.000033			
11,250	45,000	.001433	.000033			Elastic limit.
11,500	46,000	.001700	.000267			
11,750	47,000	.003333	.000800			
12,000	48,000	.004133	.000800			
12,250	49,000	.004667	.000534			
12,500	50,000	.005600	.000933			
13,000	52,000	.007167	.001567			
13,500	54,000	.008667	.001500			
14,000	56,000	.010000	.001333			
14,500	58,000	.012000	.002000			
15,000	60,000	.014000	.002000			
15,500	62,000	.016000	.002000			
16,000	64,000	.018000	.002000			
16,500	66,000	.020000	.002000			
17,000	68,000	.022667	.002667			
17,500	70,000	.025000	.002333			
18,000	72,000	.027667	.002667			
18,500	74,000	.030667	.003000			
19,000	76,000	.034000	.003333			
19,500	78,000	.038000	.004000			
20,000	80,000	.041667	.003667			
21,000	84,000	.0567	.015033			
22,000	88,000	.0667	.0100			
22,500	90,000	.0833	.0166			
23,000	92,000	.1167	.0334			
23,040	92,160	.1333	.0166			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,160
Elastic limit per square inch of original section	do...	45,080
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.001433
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1″.49 from neck
Character of broken surface		silky
Elongation of inch sections		″.14, ″.32*, ″.19

BUILDING MATERIAL.

NATURAL STONES, BRICKS, AND CEMENT.

COMPRESSION TESTS, COMPRESSIVE ELASTIC PROPERTIES,
TRANSVERSE TESTS, SHEARING TESTS,

AND

TABLE SHOWING EXPANSION AND CONTRACTION OF STONES,
AND COEFFICIENTS OF EXPANSION.

BUILDING MATERIAL.

These tests, continued from the previous year, comprise the tests of stones, bricks, cement, and fire-proof material.

Tests have been made by compression, transverse and shearing stresses, the compressive elastic properties determined, also the coefficients of expansion of the stones in water baths, the absorption of water by the brick, and chemical analyses determined.

The compression tests of the stones were made with 4-inch cubes.

The bricks were tested flatwise unless otherwise stated.

The transverse tests of stones were made with specimens 4″ x 6″ x 24″ long, the shearing specimens having the same cross-section dimensions, but were 12 inches long.

The compressive elastic properties and coefficients of expansion were determined with transverse specimens before the latter tests were made.

The compressive elastic properties, including the longitudinal compression and lateral expansion, were determined with a micrometer, shown by the photograph on the page preceding the details of the tests of the stones.

The moduli of elasticity were computed from the compressions between the loads covered by the braces in the details of the tests, deducting such permanent sets as occurred.

In computing the ratios of lateral expansion to longitudinal compression, the same range of longitudinal strains were used as taken in computing the moduli of elasticity.

The average results of those stones which were tested in each of the classes of tests are shown on the following table.

Taking the compressive strength of the material as a basis of comparison, it is shown that the transverse strength is $\frac{1}{7.3}$ and the shearing strength $\frac{1}{8.4}$ that of the compressive strength, or, stated in percentages, we find 13.6 and 11.9 the values for the transverse and shearing strengths in terms of the compressive strength of the material.

The bearing surfaces of the specimens were faced with plaster of paris to secure a favorable distribution of the loads in the testing machine.

RELATIVE STRENGTH OF STONES UNDER DIFFERENT TESTS.

GRANITES.

Description.	Compressive strength.		Transverse strength.		Shearing strength.	
	Per square inch.	Mean.	Per square inch.	Mean.	Per square inch.	Mean.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
From Braddock quarries, near Little Rock, Ark	19,599	18,953	1,704	1,644	2,088	2,235
From Milbridge, Me., "White Rock Mountain"	19,917		2,069		2,320	
From Rockville, Stearns County, Minn	18,121		1,423		1,948	
Drake's granite, from Sioux Falls, Minn	18,175		1,378		2,086	

Relative strength of stones under different tests—Continued.

MARBLES.

(From Vermont.)

Description.	Compressive strength.		Transverse strength.		Shearing strength.	
	Per square inch.	Mean.	Per square inch.	Mean.	Per square inch.	Mean.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Rutland, white	11,892	13,686	1,202	2,105	1,023	1,314
Rutland, blue	13,864		2,057		1,216	
Mountain, dark	12,833		2,109		1,453	
Sutherland Falls	16,156		3,054		1,564	

LIMESTONES.

From Isle La Motte, Vermont	14,622	12,216	2,493	2,119	2,173	1,534
From Beaver, Carroll County, Ark	20,581		2,860		1,998	
From Bowling Green, Ky	6,042		1,317		1,210	
Buff colored, from Bedford, Ind	9,012		2,058		1,222	
Blue colored, from Bedford, Ind	10,823		1,867		1,016	

SANDSTONES.

From Cromwell, Conn	16,894	14,635	2,243	2,071	1,525	1,904
From Jasper, Ala	15,630		1,889		2,202	
From Cabin Creek, Johnson County, Ark	18,468		2,442		2,479	
Quarries near Fort Smith, Ark	12,765		1,761		1,765	
From Olympia, Wash	12,665		2,073		1,642	
From Chuckanut, Wash	11,389		2,016		1,809	
Mean of all stones	14,707		2,001		1,749	
Relative strength	1 : 100%		1 : 13.6%		1 : 11.9%	

Upon making the transverse tests it was found that those stones which had previously had their coefficients of expansion determined were generally weaker than those stones which had not been exposed to the effects of the hot and cold water baths.

The table which next follows shows the comparative strength of the stones which had and which had not been subjected to these influences.

The average result shows the stones from the water baths possessed 65.1 per cent the strength of the untreated specimens—that is, the loss in strength was 34.9 per cent.

As herein classified, after passing through the hot and cold water baths, the granites possessed 83.7 per cent, the marbles 46.2 per cent, the limestones 58.8 per cent, and the sandstones 66.9 per cent of their original strength.

Included in these average results was a marble specimen which had been exposed in a hot-air muffle to a temperature of 402° F. This stone individually possessed only 24 per cent of the strength of a duplicate tested in its natural state.

RELATIVE TRANSVERSE STRENGTH OF STONES IN NATURAL STATE, AND AFTER EXPOSURE TO HOT AND COLD WATER BATHS.

GRANITES.

Description.	Modulus of rupture per square inch.			
	Natural state, total.	After exposure to hot and cold water baths.		
		Total.	Loss.	Per cent of natural state.
	Pounds.	*Pounds.*	*Pounds.*	
From Braddock quarries, near Little Rock, Ark	1,704	1,244	460	.....
From Millbridge, Me., "White Rock Mountain"	2,069	2,027	42	.....
From Rockville, Stearns County, Minn	1,423	1,230	193	.....
Drakes granite, from Sioux Falls, Minn	1,378	1,053	325	.....
From Branford, Conn	1,415	1,083	332	.....
From Troy, N. H	2,335	2,002	333	.....
Means	1,721	1,440	281	83.7

MARBLES.

Rutland white, Vermont	1,202	*a* 291	911	.....
Mountain Dark, Vermont	2,109	1,408	701	.....
Sutherland Falls, Vermont	3,054	1,531	1,523	.....
From St. Joe, Ark	1,615	567	1,048	.....
From De Kalb, St. Lawrence County, N. Y	1,144	533	611	.....
From Kennesaw quarry, Tate, Ga	1,553	605	948	.....
Means	1,779	822	957	46.2

a Heated in hot-air oven to 402° F.

LIMESTONES.

From Isle La Motte, Vermont	2,493	786	1,707	.....
From Mount Vernon, Ky	1,434	1,076	358	.....
From Beaver, Carroll County, Ark	2,860	2,247	613	.....
From Bowling Green, Ky	1,317	799	518	.....
Blue colored, from Bedford, Ind	1,867	958	909	.....
Means	1,994	1,173	821	58.8

SANDSTONES.

From Cromwell, Conn	2,243	1,500	743	.....
From Worcester quarry, East Long meadow, Mass	987	1,189	—202	.....
From Kibble quarry, East Long meadow, Mass	1,273	655	618	.....
From Cabin Creek, Johnson County, Ark	2,442	890	1,552	.....
Quarries near Fort Smith, Ark	1,761	1,185	576	.....
From Olympia, Wash	2,073	2,297	—224	.....
From Chuckanut, Wash	2,016	961	1,055	.....
From Tenino, Wash	667	323	344	.....
Means	1,683	1,125	558	66.9
Mean of all stones	.....	.....	.....	65.1

The effect of exposure to heat and moisture in the coefficient of expansion determinations caused a permanent swelling of the stones, which was developed in a different degree by the different specimens.

The relative effect of heat and moisture in producing these effects will be made the subject of subsequent tests, when more abundant data may be acquired upon the relation between permanent swelling and loss in strength.

The following table, prepared from the detailed observations on the stones during the coefficient of expansion determinations, shows the amount of swelling displayed by the different stones in passing from the cold-water bath at 32° F. through the hot-water bath at 212° F. and back again to the temperature 32° F. in the cold water.

The amount of swelling stated in the table refers to the total amount which occurred on the stones within the gauged length of 20 inches.

Specimens in sealed cases were exposed to the same range of temperature as the other stones, but were not in contact with the water of the baths.

GRANITES.

Description.	Amount of permanent swelling.
	Inch.
From Braddock quarries, near Little Rock, Ark. (light)	.0048
From Braddock quarries, near Little Rock, Ark. (dark)	.0024
From Millbridge, Me., White Rock Mountain	.0032
From Broad Rock quarry, Chesterfield County, Va	.0047
From Korah Station, Va	.0048
From Exeter, Tulare County, Cal	.0019
From Rockville, Stearns County, Minn	.0061
From Sioux Falls, Minn	.0050
From Troy, N. H.	.0021
From Branford, Conn	.0043
From Milford, Mass.	.0032
From Milford, Mass.	.0071
From Milford, Mass. (in sealed case)	.0017
Mean	.0040

MARBLES.

Rutland white, Vermont	.0135
Rutland white, Vermont (second exposure)	.0029
Mountain Dark, Vermont	.0064
Sutherland Falls, Vt	.0107
From St. Joe, Searcy County, Ark	.0196
From De Kalb, St. Lawrence County, N. Y	.0055
From Marble Hill, Ga	.0077
From Marble Hill, Ga. (in sealed case)	.0057
Mean	.0090

LIMESTONES.

From Isle La Motte, Vermont	.0081
From Wasioja, Minn	.0024
From Fort Riley, Kans	.0052
From Beaver, Carroll County, Ark	.0060
From Mount Vernon, Ky	.0075
From Darlington quarry, Rockwood, Ill	.0114
From Bowling Green, Ky	.0077
From Bedford, Washington County, Ind	.0119
From Bedford, Washington County, Ind	.0025
Mean	.0070

SANDSTONE.

Description.	Amount of permanent swelling.
	Inch.
From Cromwell, Conn	.0067
From Worcester quarry, East Longmeadow, Mass	.0022
From Kibbe quarry, East Longmeadow, Mass	.0029
From Maynard quarry, East Longmeadow, Mass	.0003
	.0019
From Kettle River quarry, Pine County, Minn	.0018
From Cabin Creek quarry, Johnson County, Ark	.0018
From Sebastian County, Ark	.0015
From Bourbon County, Kans., "Bandera stone"	.0017
From Piedmont quarry, Alameda County, Cal	.0174
From Olympia, Wash	.0035
From Chuckanut, Wash	.0052
From Tenino, Thurston County, Wash	.0148
	.0035
Mean	.0047

The brick tests were carried on in substantially the same manner as with the stones. Additional observations were made, however, with brick on the absorption of water. For this purpose the samples were weighed in their ordinary air-dried state and then again after immersion in water for a period of one week.

The table herewith presented, showing the relative compression, transverse and shearing strength, has the average results of compression based upon the tests of whole bricks.

After rupture by transverse loads the half bricks resulting therefrom were tested by compression—one-half was tested dry, the other fragment wet.

Comparing the transverse strength with the half bricks, using the dry samples, the percentage is higher than that shown in the table, being found a little less than 15 per cent of the compressive strength.

The relative results of the different tests with brick are found not unlike the corresponding results with stones, as an inspection of the two tables will show.

COMPARATIVE CRUSHING, TRANSVERSE AND SHEARING STRENGTH OF BRICKS.

Manufacturers.	Description.	Strength per square inch.		
		Compressive.	Transverse.	Shearing.
		Pounds.	*Pounds.*	*Pounds.*
Gay Head Clay and Brick Co., Chelsea, Mass.	Buff	6,707	916	1,234
New England Steam Brick Co., Providence, R. I.	Light red, No. 0	6,564	359	1,445
	Red, No. 1	6,426	1,153	1,335
	Red, No. 2	9,819	1,149	1,476
	Red, No. 3	9,585	1,223	1,567
	Red, No. 4	10,389	844	1,618
	Red, No. 5	10,367	1,553	1,819
	Light buff, No. 55.	3,306	718	989
	Light hard water struck.	5,718	1,105	1,025
	Light hard sand struck.	7,744	706	1,331
	Hard body	11,158	1,414	1,923
The Powhatan Clay Manufacturing Co., Richmond, Va.	Light red, No. 3	14,430	1,892	1,150
Gay Head Clay and Brick Co., Chelsea, Mass.	Fire brick	2,535	323	418
New England Steam Brick Co., Providence, R. I.	Paving brick	10,292	2,233	1,561
	do	13,081	1,536	1,222
Grant Brick Co., Franklin, Pa.	do	18,477	2,589	1,513
Mean		9,162	1,234	1,351
Relative strength		100 %	13.5 %	14.7 %

The fragments of the transverse specimens when subsequently tested by compression generally showed a loss in strength in the halves which were wet, these having been immersed in water for a period of one week.

The mean of all the wet samples were found to possess 85 per cent the strength of the dry ones. While 15 per cent represents the mean loss, an examination of the results shows that individually the loss may range from zero to about 35 per cent.

Furthermore, it may be seen that the greatest loss in strength occurred in medium hard and in hard brick, but not all hard brick were affected alike in this respect.

COMPRESSIVE STRENGTH OF WET AND DRY HALVES OF THE SAME BRICK.

Manufacturers.	Description.	Compressive strength per square inch.		
		Dry.	Wet.	Loss.
		Pounds.	*Pounds.*	*Pounds.*
Gay Head Clay and Brick Co., Chelsea, Mass.	Buff	5,774	4,900	874
	do	5,570	5,346	224
	Buff speckled	6,481	5,063	1,418
	Fire brick	2,639	2,321	318
	do	2,346	2,118	228
New England Steam Brick Co., Providence, R. I.	Light red, No. 0	5,874	4,506	1,368
	Red, No. 1	5,777	4,506	1,271
	Red, No. 2	7,888	8,917	—1,029
	Red, No. 3	10,624	10,482	142
	Red, No. 4	11,353	8,088	3,265
	Red, No. 5	9,671	9,674	—3
	Dark buff, No. 51	5,855	4,503	1,352
	Press, light chocolate, No. 63.	4,447	3,181	1,266
	Light hard, water struck.	5,601	4,530	1,071
	Hard body	9,655	6,230	3,425
	Light buff, No. 55.	3,599	3,289	310
	Paving	10,712	9,902	810
The Powhatan Clay Manufacturing Co., Richmond, Va.	Cream white, No. 1	4,929	4,142	787
	Dark red, No. 2	10,391	9,600	791
	Light red, No. 3	16,019	14,822	1,197
	Cream white, No. 4	4,447	4,052	395
	do	4,530	3,796	734
The Coaldale Brick and Tile Co., Coaldale, Ala.	Vitrified paving, A	15,842	11,273	4,569
John Eharker, Ashby, Ala	Fire, No. 1	2,414	1,885	529
The A. O. Jones Brick and Terra Cotta Co., Zanesville, Ohio.	Vitrified paving block.	11,942	7,941	4,001
Kansas City Hydraulic Press Brick Co., Kansas City, Mo.	Red, No. 1	18,072	11,911	6,161
	Red, No. 2	12,000	12,652	—652
Monticello Brick Works, Monticello, Minn.	Face, No. 2	16,018	15,611	407
A. Humphrey, Minneapolis, Minn	Light chocolate, No. 71.	7,724	7,037	687
Pacific Clay Manufacturing Co., Los Angeles, Cal.		2,973	2,778	195
Mean		8,039	6,835	1,204
Relative strength per cent		100	85	15

Within limits the strength of bricks increases with the hardness to which they are burned, and commonly the moduli of elasticity increase with the hardness of the material. The strength and rigidity, as shown by the modulus of elasticity, also appear to vary inversely as the amount of water absorbed.

GENERAL DESCRIPTION.

Kind of stone.	Color.	Quarry.	State.	Town or county.	Age since quarried.	Contributor.
					Months.	
Granite	Light and dark		Arkansas	Near Little Rock, Pulaski County.		John S. Braddock, Little Rock, Ark.
Do		White Rock Mountain	Maine	Milbridge		S. L. Treat & Son, Bar Harbor, Me.
Do	Light	Broad Rock	Virginia	Chesterfield County		J. H. Middendorf, Manchester, Va.
Do	do		do	Korah Station		Richmond Granite Co., Richmond, Va.
Do	do		California	Exeter, Tulare County	9	Rocky Point Granite Works, Exeter, Cal.
Do	Mottled		Minnesota	Stearns County	6	Rockville Granite Co., Rockville, Minn.
Do	Gray and red		do	Sioux Falls		Drake Company, St. Paul, Minn.
Do	Gray		New Hampshire	Troy		Charles River Stone Co., Boston, Mass.
Do	Pink		Connecticut	Branford		Do.
Do	Pinkish white		Massachusetts	Milford		Do.
Jasper			Minnesota	Sioux Falls		Drake Company, St. Paul, Minn.
Marble	White		Vermont	Rutland		Vermont Marble Co., Proctor, Vt.
Do	Blue		do	do		Do.
Do		Mountain Dark	do			Do.
Do		Sutherland Falls	do			Do.
Do	Chocolate		Arkansas	St. Joe, Searcy County	6	Dale & Jones, Little Rock, Ark.
Do	White	Richville	New York	DeKalb, St. Lawrence Co	5	Thos. S. Clarkson, Potsdam, N. Y.
Do	do		Georgia	Marble Hill		Charles River Stone Co., Boston, Mass.
Do	White crystalline		New York	Tuckahoe		Do.
Do	White clouded with gray.	Creole	Georgia	Tate		Georgia Marble Co., Tate, Ga.
Do	do	Cherokee	do	do		Do.
Do	Pink	Etowah	do	do		Do.
Do	White	Kennesaw	do	do		Do.
Limestone			Vermont	Isle La Motte	4	E. R. Goodsell, Plattsburg, N. Y.
Do	Gray and buff		Minnesota	Wasioja, Dodge County		Wasioja Stone Co.
Do	Light buff		Kansas	Junction City and Fort Riley		John Holmgren, Junction City, Kans.
Do	Drab		Kentucky	Mount Vernon	9	Dr. A. G. Lovell, Mount Vernon, Ky.
Do	Gray		Arkansas	Beaver, Carroll County	6	Bridgford & Duncan.
Limestone, Oolitic	Light gray	Darlington	Alabama	Rockwood	7	The F. L. Fossick Co., Sheffield, Ala.
Do	do		Kentucky	Bowling Green		Bowling Green Stone Co., Louisville, Ky.
Do	Buff and blue		Indiana	Bedford, Washington County		Salem-Bedford Stone Co., Louisville, Ky.
Slate	Blue		Maine	Monson		
Sandstone	Brown		Connecticut	Cromwell, Middlesex County	26	New England Brown Stone Co., Cromwell, Conn.
Do	do	Worcester	Massachusetts	East Longmeadow		Charles River Stone Co., Boston, Mass.
Do	Red	Kibbe	do	do		Do.
Do	do	Maynard	do	do		Do.
Do	Blue		Alabama	Walker County	16	Jasper Stone Quarry Co., Jasper, Ala.
Do	Salmon	Kettle River	Minnesota	Pine County	5	Minneapolis Trust Co., Minneapolis, Minn.
Do	Blue	Cabin Creek	Arkansas	Johnson County		Arkansas Stone Co., Little Rock, Ark.

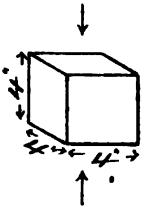
NATURAL STONES—Continued.

GENERAL DESCRIPTION—Continued.

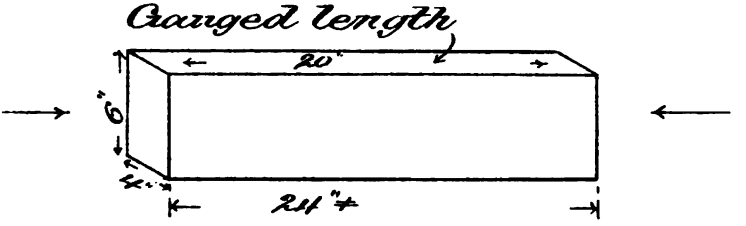
Kind of stone.	Color.	Quarry.	State.	Town or county.	Age since quarried.	Contributor.
					Months.	
Sandstone	Gray		Arkansas	Sebastian County	11	Ed. McKenna, Fort Smith, Ark.
Sandstone, "Bandera"	Blue		Kansas	Bourbon County		Bandera Flagstone Co., Redfield, Kans.
Sandstone	do	Piedmont	California	Alameda County		Wm. F. Myers, San Francisco, Cal.
Do	Bluish gray	Cooper	Oregon	Douglas County	9	Jos. G. Kelley, Roseburg, Oreg.
Do	Blue	Coquille River	do	Coos County		R. S. Littlefield, Bandore, Oreg.
Do	do	Olympia	Washington	Olympia		Geo. E. Buggins, Olympia, Wash.
Do	do	Chuckanut	do	Chuckanut		Henry Roeder, New Whatcomb, Wash.
Do	do		do	Thurston County	9	The Tenino Stone Quarry Co., Tenino, Wash.
Do	Light gray	Pittsburg	do	Pierce County	2	Clinton Stone and Coal Co., Tacoma, Wash

Tests of Stones.

Form and arrangement of specimens.



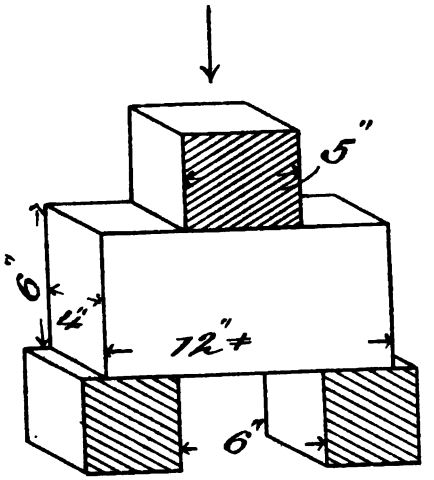
Compression tests.



Compressive Elastic Properties,
Transverse tests, and Coefficients
of expansion.

THE BYRON PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

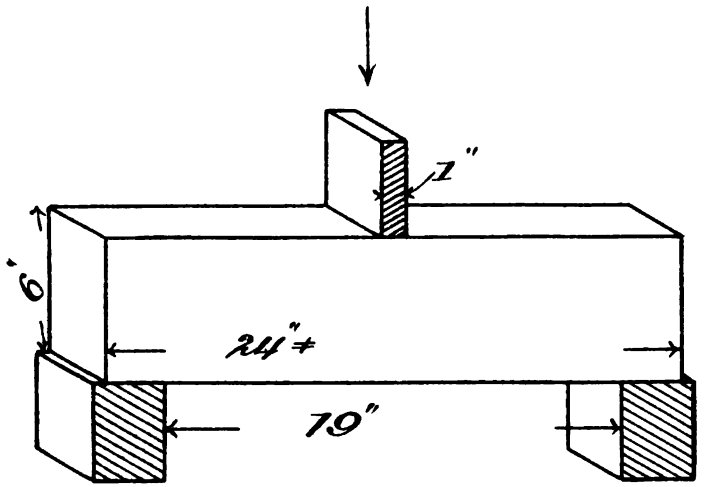
Tests of Stones.



Shearing tests.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

Tests of Stones.



Transverse tests.

THE MORRIS PETERS CO PHOTO-LITHO. WASHINGTON, D. C.

NATURAL STONES.

COMPRESSION TESTS.

NATURAL STONES.

GRANITE.

Contributed by John S. Braddock, Little Rock, Ark. Quarry located ear Little Rock, Pulaski County, Ark.

LIGHT-COLORED.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7168	4.08	3.99	4.04	16.12	146,000	360,900	22,388
7169	4.09	4.02	4.04	16.24	287,000	325,200	20,025
7170	4.01	4.03	4.01	16.16	286,000	300,200	18,577
7171	4.01	4.03	4.01	16.16	277,000	281,300	17,407

DARK-COLORED.

7172	4.00	4.02	4.02	16.16	128,000	398,400	24,653
7173	3.90	4.01	4.05	16.24	126,000	330,700	20,363
7174	4.01	4.02	4.03	16.20	334,000	445,800	27,518

GRANITE.

White Rock Mountain granite, from S. L. Treat & Son, Bar Harbor, Me. Quarries at Millbridge, Me.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7403	4.00	4.03	4.08	16.44	121,000	387,300	23,558
7404	4.02	4.02	4.06	16.32	.....	272,100	16,673
7405	4.00	4.01	3.99	16.00	137,000	312,300	19,519

GRANITE.

Contributed by J. H. Middendorf, of Manchester, Va. From Broad Rock Quarry, Chesterfield County, Va.

LIGHT-COLORED.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7497	3.98	4.07	3.90	15.87	159,000	243,600	15,350

GRANITE AND JASPER.

Contributed by the Drake Company, of St. Paul, Minn.

GRAY GRANITE.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7413	3.97	3.95	3.98	15.72	148,000	289,300	18,403

RED GRANITE.

7503	3.98	4.02	3.94	15.84	117,500	284,300	17,948

JASPER.

7504	3.90	3.85	3.92	15.09	186,000	420,200	27,846

MARBLE.

Contributed by the Vermont Marble Company, of Proctor, Vt.

RUTLAND WHITE MARBLE.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7456	3.98	4.00	4.02	16.08	189,800	189,800	11,803
7457	4.00	4.00	4.00	16.00	191,700	191,700	11,981

RUTLAND BLUE MARBLE.

7458	4.00	4.01	4.01	16.08	259,000	261,100	16,238
7459	3.98	3.98	3.98	15.84	182,000	182,000	11,490

MOUNTAIN DARK MARBLE.

7460	4.02	4.01	4.01	16.08	205,500	205,500	12,780
7461	4.00	4.01	4.01	16.08	207,200	207,200	12,886

SUTHERLAND FALLS MARBLE.

7462	4.01	4.02	4.03	16.20	255,000	267,400	16,506
7463	4.01	4.01	4.02	16.12	254,800	254,800	15,806

MARBLE.

From the Dale and Jones quarries, St. Joe, Searcy County, Ark.

FOSSILIFEROUS MARBLE.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7465	4.10	4.10	4.13	16.93	164,000	171,500	10,130
7466	4.08	4.11	4.10	16.85	173,000	175,100	10,393
7467	4.06	4.13	4.10	16.93	173,000	176,300	10,413

CHOCOLATE-COLORED MARBLE.

7468	4.10	4.09	4.04	16.52	198,000	206,400	12,494
7469	4.05	4.06	4.08	16.56	143,000	227,900	13,762
7470	4.10	4.10	4.10	16.81	93,000	177,800	10,577

MARBLE.

Richville white marble from De Kalb, St. Lawrence County, N. Y. Contributed by Thomas S. Clarkson, Potsdam, N. Y.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7181	4.11	4.07	4.08	16.61	228,100	228,100	13,733
7182	3.83	4.02	4.16	16.72	169,000	175,200	10,478
7183	3.89	4.15	4.04	16.77	182,000	201,300	12,004
7464	4.10	3.76	4.02	15.11	208,100	208,100	13,772

LIMESTONE.

Contributed by E. R. Goodsell, of Plattsburg, N. Y. Quarries at Isle La Motte, Vermont.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7495	4.01	4.02	3.98	16.00	72,000	218,600	13,662
7496	4.00	4.00	4.00	16.00	91,000	249,300	15,581

LIMESTONE.

Contributed by the Wasioja Stone Company. Quarry located at Wasioja, Dodge County, Minn., on the banks of a branch of the Zumbro River.

BUFF COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7481	3.98	4.10	4.08	16.73	31,000	67,400	4,029

GRAY COLOR.

7482	4.10	4.10	4.08	16.73	70,000	83,900	5,014

LIMESTONE.

Contributed by John Holmgren, Junction City, Kans.

JUNCTION CITY WHITE ROCK.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7700	3.98	4.00	3.88	15.52	44,000	46,500	2,996
7701	3.93	3.87	3.98	15.40	51,000	51,600	3,350

LIMESTONE.

Contributed by Bridgford & Duncan. Quarry located at Beaver, Carroll County, Ark.

GRAY COLOR.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7489	No. 1....	3.98	4.13	4.14	17.10	320,000	346,800	20,281
7490	No. 1....	4.07	4.14	4.10	16.97	301,000	363,100	21,397
7491	No. 2....	4.02	4.13	4.15	17.14	130,000	343,900	20,064

LIMESTONE.

Darlington oolitic limestone, contributed by the F. L. Fossick Company, of Sheffield, Ala. Quarries and mills at Rockwood, Ala.

LIGHT GRAY COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7471	4.03	3.98	4.01	15.96	91,800	91,800	5,752
7472	3.95	4.00	4.00	16.00	98,000	98,600	6,162

LIMESTONE.

Oolitic limestone, contributed by the Bowling Green Stone Company, of Louisville, Ky.

LIGHT GRAY COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7473	4.00	3.98	3.94	15.68	94,200	94,200	6,008
7474	4.00	3.99	3.98	15.88	96,500	96,500	6,077

LIMESTONE.

Oolitic limestone, from the Salem-Bedford Stone Company, of Louisville, Ky. From quarries at Bedford, Washington County, Ind.

BUFF COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7475	3.98	3.98	4.00	15.92	166,300	166,300	10,446
7476	4.00	4.00	3.99	15.96	145,700	145,700	9,129
7477	4.00	4.00	3.96	15.84	118,200	118,200	7,462

BLUE COLOR.

7478	3.92	4.07	4.07	16.56	192,700	192,700	11,636
7479	3.92	3.99	4.03	15.72	176,800	176,800	11,247
7480	4.09	3.92	4.13	16.19	155,200	155,200	9,586

SANDSTONE.

Contributed by the New England Brown Stone Company, of Cromwell, Conn. Quarries located at Cromwell, Middlesex County, Conn.

BROWN COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7483	3.93	4.02	3.96	15.92	279,500	279,500	17,557
7484	3.93	3.93	3.97	15.60	253,200	253,200	16,231

BLUE SANDSTONE.

Contributed by the Jasper Stone Quarry Company, of Jasper, Ala. Stone quarried August, 1893. Cut April, 1894. Quarry located in Walker County, Ala.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7820	4.08	4.01	4.00	16.04	265,900	265,900	16,570
7821	4.02	4.02	4.03	16.20	269,300	269,300	16,620
7822	4.04	4.01	4.02	16.12	220,800	220,800	13,700

SANDSTONE.

Contributed by the Minneapolis Trust Company, of Minneapolis, Minn. From Kettle River quarry, at Sandstone, Pine County, Minn.

SALMON COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7487	4.06	4.12	4.03	16.60	191,000	204,100	12,295
7488	4.00	4.05	4.05	16.40	145,000	209,900	12,799

SANDSTONE.

Contributed by the Arkansas Stone Company, of Little Rock, Ark. Quarries at Cabin Creek, Johnson County, Ark.

BLUE STONE.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7492	4.03	3.95	4.08	16.12	105,000	318,300	19,746
7493	4.00	4.03	4.01	16.16	108,000	289,600	17,921
7494	4.02	4.03	4.07	16.40	206,000	290,900	17,738

SANDSTONE.

Stone contributed by Ed. McKenna. Quarries near Fort Smith, Sebastian County, Ark. Stones marked "Jensen, Ark."

GRAY COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7830	10.50	4.09	3.96	16.20	151,000	187,600	11,580
7831	11.07	4.08	4.04	16.48	120,500	229,900	13,950

"BANDERA" SANDSTONE.

Contributed by The Bandera Flagstone Company, of Redfield, Kans. Quarries near Redfield, Bourbon County, Kans., about 11 miles west of Fort Scott, Kans.

BLUE COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7485	3.94	4.01	3.98	15.96	134,800	134,800	8,446
7486	3.93	3.98	3.96	15.76	119,900	119,900	7,608

SANDSTONE.

Contributed by W. F. Myers, San Francisco, Cal. From the Piedmont quarry, located about 5½ miles from Oakland, Alameda County, Cal.

BLUE COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7613	4.10	4.03	4.11	16.56	169,000	195,600	11,812
7614	4.04	4.04	4.12	16.64	62,000	182,900	10,991
7615	4.05	4.08	4.07	16.61	167,000	171,400	10,319

SANDSTONE.

From R. S. Littlefield, of Bandore, Coos County, Oreg. Stones marked Coquille River, Coos County, Oreg.

BLUE COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7414	3.90	3.98	4.08	16.24	147,100	147,100	9,057
7415	4.03	4.00	4.12	16.48	133,000	137,400	8,337
7416	3.97	4.00	3.85	15.40	72,000	76,200	4,948

NOTE.—No. 7416 was tested wet, after 22 hours immersion in water. After fracture the stone indicated that the water had penetrated to a depth of about five-eighths of an inch below the surfaces of the cube.

SANDSTONE.

Contributed by the Tenino Stone Quarry Company, of Tenino, Thurston County, Wash.

GRAYISH GREEN COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7418	4.02	4.00	4.05	16.20	108,400	108,400	6,691
7419	4.01	4.00	4.05	16.20	106,380	106,380	6,567
7420	4.02	3.98	4.04	16.08	109,440	109,440	6,806

SANDSTONE.

Contributed by the Clinton Stone and Coal Company, of Tacoma, Wash. Quarries located at Pittsburg, Pierce County, Wash. Stone quarried November 4, 1894.

LIGHT GRAY COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7823	4.00	3.99	3.99	15.92	305,800	305,800	19,208

NATURAL STONES.

COMPRESSIVE ELASTIC PROPERTIES.

VIEW SHOWING MICROMETER IN POSITION ON STONE FOR MEASURING COMPRESSIONS.

NATURAL STONES.

GRANITE FROM QUARRIES NEAR LITTLE ROCK, PULASKI COUNTY, ARK.—LIGHT COLORED.

No. 1349.

Length, 24″.
Sectional area, 4″.06×6″.03=24.48 square inches.
Weight, 53 pounds 2 ounces=156.2 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In guaged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,448	100	0.	0.	Initial load.
24,480	1,000	.0033	.....	
48,960	2,000	.0067	.....	
73,440	3,000	.0102	.....	
97,920	4,000	.0134	.....	
122,400	5,000	.0166	.....	E = 6,090,000 pounds per square inch.
97,920	4,000	.0141	.....	
73,440	3,000	.0114	.....	
48,960	2,000	.0084	.....	
24,480	1,000	.0049	.....	
2,448	100	.....	.0005	
24,480	1,000	.0045	.....	
48,960	2,000	.0079	.....	
73,440	3,000	.0110	.....	
97,920	4,000	.0138	.....	
122,400	5,000	.0166	.....	
97,920	4,000	.0141	.....	
73,440	3,000	.0114	.....	
48,960	2,000	.0084	.....	
24,480	1,000	.0049	.....	
2,448	100	.....	.0005	

Lateral expansion under endwise compression.
Transverse guaged length, 5″.5 at middle of length.

Applied loads.		In guaged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,448	100	0.	0.	Initial load.
122,400	5,000	.0009	.....	
2,448	100	.....	0.	
122,400	5,000	.0009	.....	
2,448	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{15}$.
This specimen used in transverse test No. 460.

GRANITE FROM QUARRIES NEAR LITTLE ROCK, PULASKI COUNTY, ARK.—LIGHT COLORED.

No. 1333.

Length, 24″.
Sectional area, 4″.00 × 6″.03 = 24.12 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,412	100	0.	0.	Initial load.
24,120	1,000	.0029	.....	
48,240	2,000	.0064	.....	
72,360	3,000	.0093	.....	
96,480	4,000	.0118	.....	
120,600	5,000	.0143	.....	E = 6,950,000 pounds per square inch.
96,480	4,000	.0118	.....	
72,360	3,000	.0090	.....	
48,240	2,000	.0063	.....	
24,120	1,000	.0031	.....	
2,412	100	.....	.0002	
24,120	1,000	.0029	.....	
48,240	2,000	.0059	.....	
72,360	3,000	.0089	.....	
96,480	4,000	.0116	.....	
120,600	5,000	.0143	.....	
96,480	4,000	.0117	.....	
72,360	3,000	.0090	.....	
48,240	2,000	.0062	.....	
24,120	1,000	.0026	.....	
2,412	100	.....	.0002	

Lateral expansion under endwise compression.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,412	100	0.	0.	Initial load.
120,600	5,000	.0008	.....	
2,412	100	.....	.0001	
120,600	5,000	.0009	.....	
2,412	100	.....	.0001	
120,600	5,000	.0009	.....	
2,412	100	.....	.0001+	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{4.3}$.
This specimen used in transverse test No. 393.

GRANITE FROM QUARRIES NEAR LITTLE ROCK, PULASKI COUNTY, ARK.—LIGHT COLORED.

No. 1334.

Length, 24″.04.
Sectional area, 4″.06×6″.11=24.81 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,481	100	0.	0.	Initial load.
24,810	1,000	.0032	.....	
49,620	2,000	.0063	.....	
74,430	3,000	.0088	.....	
99,240	4,000	.0113	.....	
124,050	5,000	.0135	.....	
99,240	4,000	.0114	.....	
74,430	3,000	.0085	.....	E=8,160,000 pounds per square inch.
49,620	2,000	.0061	.....	
24,810	1,000	.0034	.....	
2,481	100	.....	.0015	
24,810	1,000	.0031	.....	
49,620	2,000	.0057	.....	
74,430	3,000	.0085	.....	
99,240	4,000	.0113	.....	
124,050	5,000	.0139	.....	
99,240	4,000	.0115	.....	
74,430	3,000	.0089	.....	
49,620	2,000	.0062	.....	
24,810	1,000	.0036	.....	
2,481	100	.....	.0018	

Lateral expansion under endwise compression.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,481	100	0.	0.	Initial load.
124,050	5,000	.0007	.....	
2,481	100	.....	0.	
124,050	5,000	.0007	.....	
2,481	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{4.7}$.
This specimen used in transverse test No. 392.

WHITE ROCK MOUNTAIN GRANITE FROM MILLBRIDGE, ME.

No. 1332.

Length, 23″.92.
Sectional area, 4″.12 × 6″.09 = 25.09 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,509	100	0.	0.	Initial load.
25,090	1,000	.0023	.....	
50,180	2,000	.0047	.....	
75,270	3,000	.0069	.....	
100,360	4,000	.0089	.....	
125,450	5,000	.0108	.....	E=9,800,000 pounds per square inch.
100,360	4,000	.0089	.....	
75,270	3,000	.0069	.....	
50,180	2,000	.0050	.....	
25,090	1,000	.0030	.....	
2,509	100	.....	.0008	
25,090	1,000	.0027	.....	
50,180	2,000	.0045	.....	
75,270	3,000	.0067	.....	
100,360	4,000	.0088	.....	
125,450	5,000	.0108	.....	
100,360	4,000	.0089	.....	
75,270	3,000	.0069	.....	
50,180	2,000	.0049	.....	
25,090	1,000	.0030	.....	
2,509	100	.....	.0006	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,509	100	0.	0.	Initial load.
125,450	5,000	.0005	.....	
2,509	100	.....	.0001	
125,450	5,000	.0005	.....	
2,509	100	.....	.0001	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{6.5}$.
This specimen used in transverse test No. 391.

GRANITE FROM ROCKVILLE, STEARNS COUNTY, MINN.

No. 1335.

Length, 23″.97.
Sectional area, 4″.08×6″.01=24.52 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,452	100	0.	0.	Initial load.
24,520	1,000	.0022	.....	
49,040	2,000	.0045	.....	
73,560	3,000	.0067	.....	
98,080	4,000	.0089	.....	
122,600	5,000	.0109	.....	
98,080	4,000	.0090	.....	
73,560	3,000	.0071	.....	E=9,420,000 pounds per square inch.
49,040	2,000	.0052	.....	
24,520	1,000	.0031	.....	
2,452	100	.....	.0005	
24,520	1,000	.0028	.....	
49,040	2,000	.0049	.....	
73,560	3,000	.0069	.....	
98,080	4,000	.0089	.....	
122,600	5,000	.0110	.....	
98,080	4,000	.0092	.....	
73,560	3,000	.0072	.....	
49,040	2,000	.0053	.....	
24,520	1,000	.0031	.....	
2,452	100	.....	.0006	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,452	100	0.	0.	Initial load.
122,600	5,000	.0006	.....	
2,452	100	.....	0.	
122,600	5,000	.0006	.....	
2,452	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{4.7}$.
This specimen used in transverse test No. 394.

RED GRANITE FROM DRAKE COMPANY, ST. PAUL, MINN.

No. 1336.

Length, 24″.07.
Sectional area, 3″.96×5″.99=23.72 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,372	100	0.	0.	Initial load.
23,720	1,000	.0053	.....	
47,440	2,000	.0088	.....	
71,160	3,000	.0115	.....	
94,880	4,000	.0144	.....	
118,600	5,000	.0174	.....	
94,880	4,000	.0149	.....	
71,160	3,000	.0124	.....	E=6,010,000 pounds per square inch.
47,440	2,000	.0092	.....	
23,720	1,000	.0052	.....	
2,372	100	.....	.0011	
23,720	1,000	.0043	.....	
47,440	2,000	.0083	.....	
71,160	3,000	.0116	.....	
94,880	4,000	.0146	.....	
118,600	5,000	.0176	.....	
94,880	4,000	.0151	.....	
71,160	3,000	.0125	.....	
47,440	2,000	.0094	.....	
23,720	1,000	.0054	.....	
2,372	100	.....	.0014	

Lateral expansion under endwise compression.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,372	100	0.	0.	Initial load.
118,600	5,000	.0006	.....	
2,372	100	.....	0.	
118,600	5,000	.0006	.....	
2,372	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{10}$.

GRANITE FROM TROY, N. H.

No. 1344.

Length, 24″.04.
Sectional area, 4″.09 × 6″.09 = 24.91 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,491	100	0.	0.	Initial load.
24,910	1,000	.0068	.....	
49,820	2,000	.0133	.....	
74,730	3,000	.0176	.....	
99,640	4,000	.0212	.....	
124,550	5,000	.0245	.....	
99,640	4,000	.0219	.....	
74,730	3,000	.0191	.....	E = 4,800,000 pounds per square inch.
49,820	2,000	.0157	.....	
24,910	1,000	.0113	.....	
2,491	100	.....	.0041	
24,910	1,000	.0092	.....	
49,820	2,000	.0141	.....	
74,730	3,000	.0180	.....	
99,640	4,000	.0213	.....	
124,550	5,000	.0245	.....	
99,640	4,000	.0219	.....	
74,730	3,000	.0191	.....	
49,820	2,000	.0157	.....	
24,910	1,000	.0113	.....	
2,491	100	.....	.0042	

Lateral expansion under endwise compression.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,491	100	0.	0.	Initial load.
124,550	5,000	.0007	.....	
2,491	100	.....	0.	
124,550	5,000	.0007	.....	
2,491	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{8}$.
This specimen used in transverse test No. 390.

GRANITE FROM BRANFORD, CONN.

No. 1345.

Length, 24″.04.
Sectional area, 4″.08×6″.04=24.64 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,464	100	0.	0.	Initial load.
24,640	1,000	.0038	.....	
49,280	2,000	.0073	.....	
73,920	3,000	.0102	.....	
98,560	4,000	.0129	.....	
123,200	5,000	.0156	.....	
98,560	4,000	.0133	.....	
73,920	3,000	.0109	.....	E=6,710,000 pounds per square inch.
49,280	2,000	.0084	.....	
24,640	1,000	.0052	.....	
2,464	100	.....	.0010	
24,640	1,000	.0045	.....	
49,280	2,000	.0078	.....	
73,920	3,000	.0105	.....	
98,560	4,000	.0130	.....	
123,200	5,000	.0157	.....	
98,560	4,000	.0133	.....	
73,920	3,000	.0110	.....	
49,280	2,000	.0084	.....	
24,640	1,000	.0052	.....	
2,464	100	.....	.0010	

Lateral expansion under endwise compression.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,464	100	0.	0.	
123,200	5,000	.0007	.....	
2,464	100	.....	0.	
123,200	5,000	.0007	.....	
2,464	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{4.7}$.
This specimen used in transverse test No. 389.

GRANITE FROM BRANFORD, CONN.

Coefficient of expansion previously determined in water baths.

No. 1348.

Length, 24″.05.
Sectional area, 4″.07 × 6″.08 = 24.75 square inches.
Weight, 55½ pounds = 161.1 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,475	100	0.	0.	Initial load.
24,750	1,000	.0100	.....	
49,500	2,000	.0161	.....	
74,250	3,000	.0204	.....	
99,000	4,000	.0238	.....	
74,250	3,000	.0213	.....	
49,500	2,000	.0183	.....	E = 4,610,000 pounds per square inch.
24,750	1,000	.0142	.....	
2,475	100	.....	.0069	
24,750	1,000	.0130	.....	
49,500	2,000	.0175	.....	
74,250	3,000	.0209	.....	
99,000	4,000	.0239	.....	
74,250	3,000	.0214	.....	
49,500	2,000	.0184	.....	
24,750	1,000	.0144	.....	
2,475	100	.....	.0072	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,475	100	0.	0.	Initial load.
99,000	4,000	.0004	.....	
2,475	100	.....	0.	
99,000	4,000	.0004	.....	
2,475	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{11.4}$.
This specimen used in transverse test No. 459.

GRANITE FROM MILFORD, MASS.

Coefficient of expansion previously determined with the dry stone in a sealed brass case.

No. 1346.

Length, 24″.07.
Sectional area, 4″.08 × 6″.08 = 24.81 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,481	100	0.	0.	Initial load.
24,810	1,000	.0072	.....	
49,620	2,000	.0124	.....	
74,430	3,000	.0164	.....	
99,240	4,000	.0197	.....	
124,050	5,000	.0228	.....	
99,240	4,000	.0203	.....	
74,430	3,000	.0174	.....	
49,620	2,000	.0141	.....	E = 5,850,000 pounds per square inch.
24,810	1,000	.0098	.....	
2,481	100	.....	.0029	
24,810	1,000	.0087	.....	
49,620	2,000	.0131	.....	
74,430	3,000	.0168	.....	
99,240	4,000	.0200	.....	
124,050	5,000	.0228	.....	
99,240	4,000	.0203	.....	
74,430	3,000	.0174	.....	
49,620	2,000	.0142	.....	
24,810	1,000	.0099	.....	
2,481	100	.....	.0029	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,481	100	0.	0.	Initial load.
124,050	5,000	.0007	.....	
2,481	100	.....	0.	
124,050	5,000	.0007	.....	
2,481	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{7.5}$.

GRANITE FROM MILFORD, MASS.

Coefficient of expansion previously determined in water baths.

No. 1347.

Length, 23″.98.
Sectional area, 4″.05 × 6″.06 = 24.54 square inches.
Weight, 55½ pounds = 162.9 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,454	100	0.	0.	Initial load.
24,540	1,000	.0090	.....	
49,080	2,000	.0151	.....	
73,620	3,000	.0195	.....	
98,160	4,000	.0229	.....	
122,700	5,000	.0260	.....	
98,160	4,000	.0235	.....	
73,620	3,000	.0207	.....	E = 4,680,000 pounds per square inch.
49,080	2,000	.0174	.....	
24,540	1,000	.0129	.....	
2,454	100	.....	.0051	
24,540	1,000	.0113	.....	
49,080	2,000	.0163	.....	
73,620	3,000	.0199	.....	
98,160	4,000	.0231	.....	
122,700	5,000	.0260	.....	
98,160	4,000	.0235	.....	
73,620	3,000	.0207	.....	
49,080	2,000	.0175	.....	
24,540	1,000	.0130	.....	
2,454	100	.....	.0052	

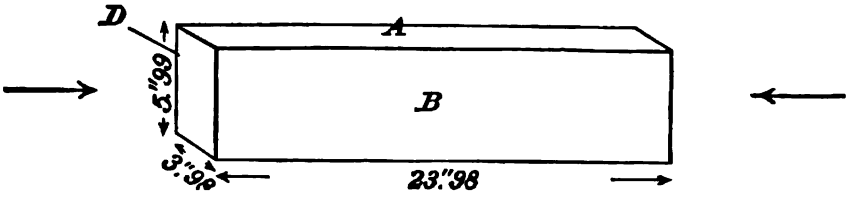
Lateral expansion under endwise compression.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,454	100	0.	0.	Initial load.
122,700	5,000	.0004	.....	
2,454	100	.....	0.	
122,700	5,000	.0004	.....	
2,454	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{14.3}$.
This specimen used in transverse test No. 458.

RUTLAND WHITE MARBLE FROM VERMONT.

No. 1313.



Length, 23″.98.
Sectional area, 3″.98×5″.99=23.84 square inches.
Gauged length, 20″ on face A.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,384	100	0.	0.	Initial load.
4,768	200	.0007	.....	
7,152	300	.0013	.....	
9,536	400	.0020	.....	
11,920	500	.0026	.0005	
14,304	600	.0031	.....	
16,688	700	.0037	.....	
19,072	800	.0043	.....	
21,456	900	.0049	.....	
23,840	1,000	.0054	.0012	
28,608	1,200	.0063	.....	
33,376	1,400	.0074	.....	
38,144	1,600	.0084	.....	
42,912	1,800	.0093	.....	
47,680	2,000	.0102	.....	
23,840	1,000	.0071	.....	
2,384	100	.....	.0020	
23,840	1,000	.0063	.....	
47,680	2,000	.0102	.....	
59,600	2,500	.0120	.....	
71,520	3,000	.0140	.....	
83,440	3,500	.0157	.....	
95,360	4,000	.0175	.0037	
107,280	4,500	.0192	.....	
119,200	5,000	.0208	.....	
131,120	5,500	.0225	.....	
143,040	6,000	.0243	.....	
95,360	4,000	.0201	.....	
47,680	2,000	.0148	.....	
23,840	1,000	.0118	.....	
2,384	100	.....	.0051	
23,840	1,000	.0096	.....	
47,680	2,000	.0133	.....	
95,360	4,000	.0192	.....	
47,680	2,000	.0142	.....	
23,840	1,000	.0109	.....	
2,384	100	.....	.0053	
23,840	1,000	.0095	.....	
47,680	2,000	.0133	.....	
.....	.....	.0133	.....	After sustaining load 5 minutes.
95,360	4,000	.0191	.....	
.....	.....	.0191	.....	Do.
47,680	2,000	.0142	.....	
.....	.....	.0142	.....	Do.
23,840	1,000	.0109	.....	
2,384	100	.....	.0053	
23,840	1,000	.0097	.....	
47,680	2,000	.0133	.....	
.....	.....	.0136	.....	After sustaining load 16 hours.
23,840	1,000	.0107	.....	
2,384	100	.....	.0055	
2,384	100	.....	.0055	After 10 minutes' rest.
23,840	1,000	.0099	.....	
47,680	2,000	.0133	.....	

No. 1313—Continued.

Applied loads		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
95, 360	4,000	.0192	.....	
47, 680	2,000	.0143	.....	
23, 840	1,000	.0111	.....	
2, 384	100	.....	.0057	
47, 680	2,000	.0135	.....	
2, 384	100	.....	.0057	
				Load released, stone rotated one-fourth of a turn in the testing machine, and test resumed. Ganged length 20″ on face B.
2, 384	100	0.	0.	Initial load.
23, 840	1,000	.0063	.0009	
47, 680	2,000	.0102	.....	
95, 360	4,000	.0164	.....	
47, 680	2,000	.0113	.....	
23, 840	1,000	.0077	.....	
2, 384	100	.....	.0015	
23, 840	1,000	.0065	.....	
47, 680	2,000	.0103	.....	
95, 360	4,000	.0164	.....	
47, 680	2,000	.0113	.....	E = 5,270,000 pounds per square inch.
23, 840	1,000	.0078	.....	
2, 384	100	.....	.0016	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5″.5.

Applied loads.		In gauged length.		Remarks.
Total	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2, 384	100	0.	0.	Initial load, 5″.5.
47, 680	2,000	.0002	.....	
95, 360	4,000	.0006	.....	
47, 680	2,000	.0003	.....	
2, 384	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{6.5}$.
This specimen used in transverse test No. 414.

RUTLAND WHITE MARBLE FROM VERMONT.

Coefficient of expansion previously determined in water baths.

No. 1356.

Length, 24″.02.
Sectional area, 4″.01 × 6″.02 = 24.14 square inches.
Weight, 56¼ pounds = 167.6 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,414	100	0.	0.	Initial load.
12,070	500	.0136	.....	
24,140	1,000	.0210	.....	
36,210	1,500	.0259	.....	
48,280	2,000	.0297	.....	
60,350	2,500	.0330	.....	
72,420	3,000	.0358	.....	
84,490	3,500	.0386	.....	
96,560	4,000	.0410	.....	
72,420	3,000	.0382	.....	
48,280	2,000	.0348	.....	E = 3,640,000 pounds per square inch.
24,140	1,000	.0302	.....	
2,414	100	.....	.0196	
24,140	1,000	.0274	.....	
48,280	2,000	.0328	.....	
72,420	3,000	.0371	.....	
96,560	4,000	.0411	.....	
72,420	3,000	.0383	.....	
48,280	2,000	.0351	.....	
24,140	1,000	.0304	.....	
2,414	100	.....	.0208	

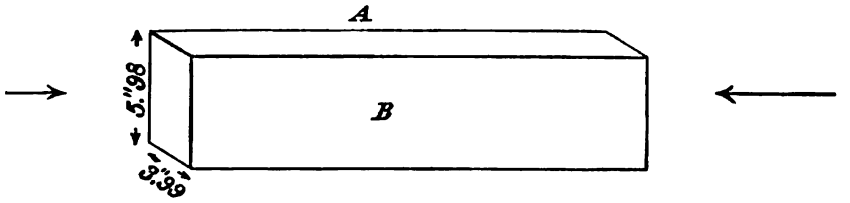
Lateral expansion under endwise compression loads.
Transverse gauged length 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,414	100	0.	0.	Initial load.
96,560	4,000	.0010	.....	
2,414	100	.....	0.	
96,560	4,000	.0010	.....	
2,414	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{4.3}$.
This specimen used in transverse test No. 467.

RUTLAND BLUE MARBLE, FROM VERMONT.

No. 1314.



Length, 24".
Sectional area, 3".99×5".98=23.86 square inches.
Gauged length, 5" on face A.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,386	100	0.	0.	Initial load.
23,860	1,000	.0007	.....	
47,720	2,000	.0017	.....	
71,580	3,000	.0025	.....	
95,440	4,000	.0032	.....	E=6,500,000 pounds per square inch.
2,386	100	.....	.0002	
95,440	4,000	.0032	.....	
2,386	100	.....	.0002	
				Stone rotated one-fourth of a turn in the testing machine and test resumed. Gauged length, 5" on face B at middle of length.
2,386	100	0.	0.	Initial load.
23,860	1,000	.0007	.....	
47,720	2,000	.0014	.....	
71,580	3,000	.0021	.....	
95,440	4,000	.0026	.....	E=7,800,000 pounds per square inch.
2,386	100	.....	.0001	
95,440	4,000	.0026	.....	
2,386	100	.....	.0001	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5".5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,386	100	0.	0.	Initial load.
95,440	4,000	.0006	.....	
2,386	100	.....	0.	
95,440	4,000	.0006	.....	
2,386	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{4.6}$.
This specimen used in transverse test No. 416.

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Transverse gauged length, 5″.5 located $\frac{7}{8}$″ from north end of stone.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,404	100	0.	0.	Initial load.
96,160	4,000	.0003	.....	
2,404	100	.....	0.	
96,160	4,000	.0003	.....	
2,404	100	.....	0.	

Transverse gauged length, 5″.5, located $\frac{7}{8}$″ from south end of stone.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,404	100	0.	0.	Initial load.
96,160	4,000	.0007	.....	
2,404	100	.....	0.	
96,160	4,000	.0007	.....	
2,404	100	.....	0.	

This specimen used in transverse test No. 417.

SUTHERLAND FALLS MARBLE FROM VERMONT.

No. 1316.

Length, 24″.04.
Sectional area, 4″.02 × 6″.01 = 24.16 square inches.
Lateral expansion under endwise compression loads.
Transverse gauged length, 5″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,416	100	0.	0.	Initial load.
96,640	4,000	.0004	.....	
2,416	100	.....	0.	
96,640	4,000	.0004	.....	
2,416	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{47}$.

Longitudinal compression. Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,416	100	0.	0.	Initial load.
24,160	1,000	.0011	.....	
48,320	2,000	.0027	.....	
72,480	3,000	.0045	.....	
96,640	4,000	.0063	.....	E = 12,580,000 pounds per square inch.
72,480	3,000	.0045	.....	
48,320	2,000	.0029	.....	
24,160	1,000	.0012	.....	
2,416	100	.....	.0001	
96,640	4,000	.0063	.....	
2,416	100	.....	.0002	
96,640	4,000	.0064	.....	
2,416	100	.....	.0002	

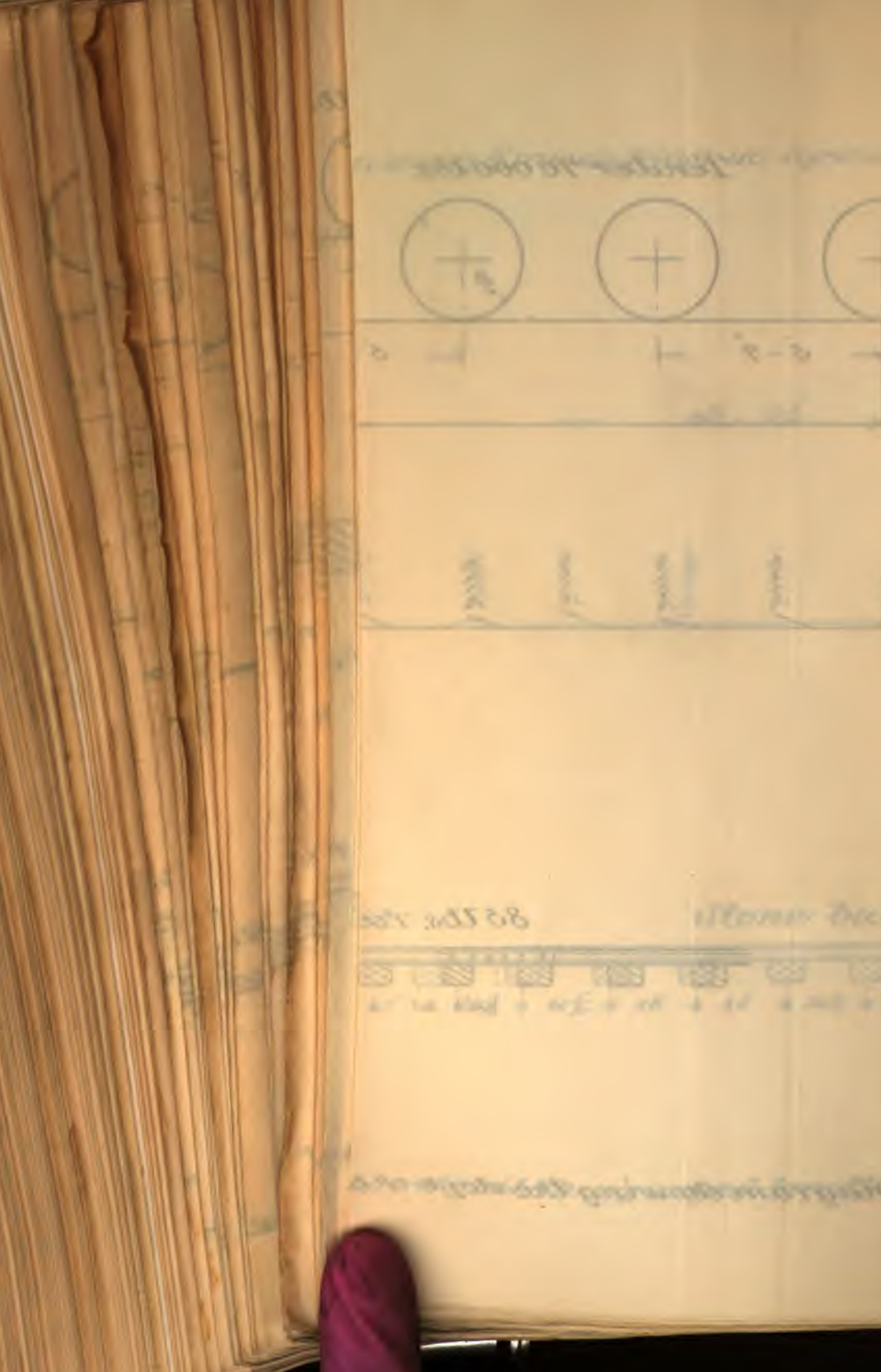
This specimen used in transverse test No. 418.

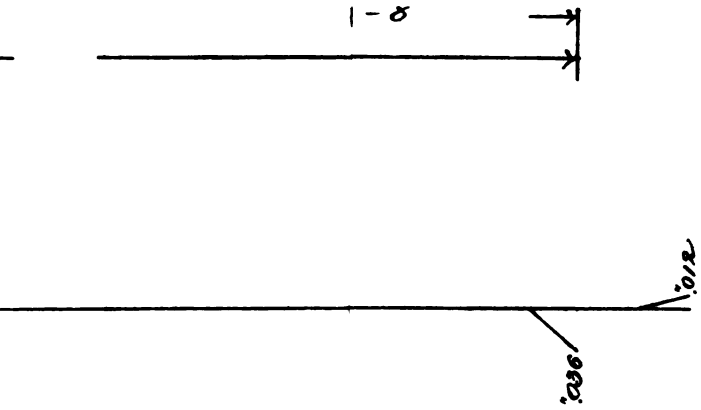
Fossiliferous Marble from St. Joe, Searcy County, Ark.

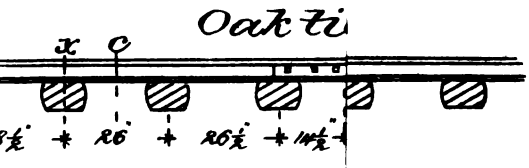
No. 1319.

Length, 24″.10.
Sectional area, 4″.10 × 6″.18 = 25.34 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,534	100	0.	0.	Initial.
25,340	1,000	.0022	.....	
50,680	2,000	.0045	.....	
76,020	3,000	.0073	.....	
101,360	4,000	.0099	.....	E = 8,210,000 pounds per square inch.
76,020	3,000	.0079	.....	
50,680	2,000	.0058	.....	
25,340	1,000	.0034	.....	
2,534	100	.....	.0004	
25,340	1,000	.0032	.....	
50,680	2,000	.0055	.....	
76,020	3,000	.0077	.....	
101,360	4,000	.0099	.....	
76,020	3,000	.0079	.....	
50,680	2,000	.0058	.....	
25,340	1,000	.0034	.....	
2,534	100	.....	.0004	







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MARBLE FROM MARBLE HILL, GA.

Coefficient of expansion previously determined in water baths.

No. 1354.

Length, 24″.03.
Sectional area, 4″.03 × 6″.04 = 24.34 square inches.
Weight, 56¾ pounds = 167.7 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,434	100	0.	0.	Initial load.
24,340	1,000	.0226	.....	
36,510	1,500	.0279	.....	
2,434	100	.....	.0181	
48,680	2,000	.0322	.....	
73,020	3,000	.0379	.....	
97,360	4,000	.0424	.....	E=4,480,000 pounds per square inch.
73,020	3,000	.0401	.....	
48,680	2,000	.0373	.....	
24,340	1,000	.0336	.....	
2,434	100	.....	.0250	
24,340	1,000	.0317	.....	
48,680	2,000	.0361	.....	
73,020	3,000	.0395	.....	
97,360	4,000	.0427	.....	
73,020	3,000	.0405	.....	
48,680	2,000	.0377	.....	
24,340	1,000	.0340	.....	
2,434	100	.....	.0258	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,434	100	0.	0.	Initial load.
97,360	4,000	.0002	.....	
2,434	100	.....	.0000	
97,360	4,000	.0002	.....	
2,434	100	.....	—.0001	
97,360	4,000	.0002	.....	
2,434	100	.....	—.0001	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{16.1}$
This specimen used in transverse test No. 465.

MARBLE FROM MARBLE HILL, GA.

Coefficient of expansion previously determined with the dry stone in brass case.

No. 1355.

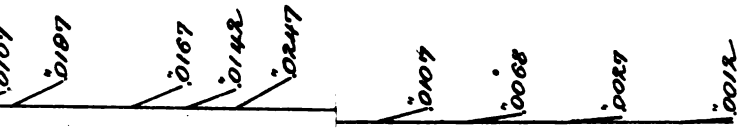
Length, 23″.98.
Sectional area, 4″.02 × 6″.01 = 24.16 square inches.
Weight, 56¼ pounds = 167.8 pounds per cubic foot.
Gauged length, 20″.

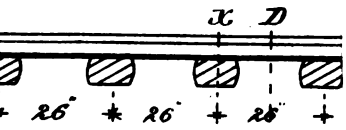
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,416	100	0.	0.	Initial load.
24,160	1,000	.0045	.....	
48,320	2,000	.0085	.....	
72,480	3,000	.0119	.....	
96,640	4,000	.0147	.....	
72,480	3,000	.0127	.....	
48,320	2,000	.0105	.....	E = 6,550,000 pounds per square inch.
24,160	1,000	.0077	.....	
2,416	100	.....	.0028	
24,160	1,000	.0068	.....	
48,320	2,000	.0099	.....	
72,480	3,000	.0124	.....	
96,640	4,000	.0147	.....	
72,480	3,000	.0127	.....	
48,320	2,000	.0104	.....	
24,160	1,000	.0076	.....	
2,416	100	.....	.0028	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,416	100	0.	0.	Initial load.
96,640	4,000	.0005	.....	
2,416	100	.....	0.	
96,640	4,000	.0005	.....	
2,416	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{6.5}$.
This specimen used in transverse test No. 466.





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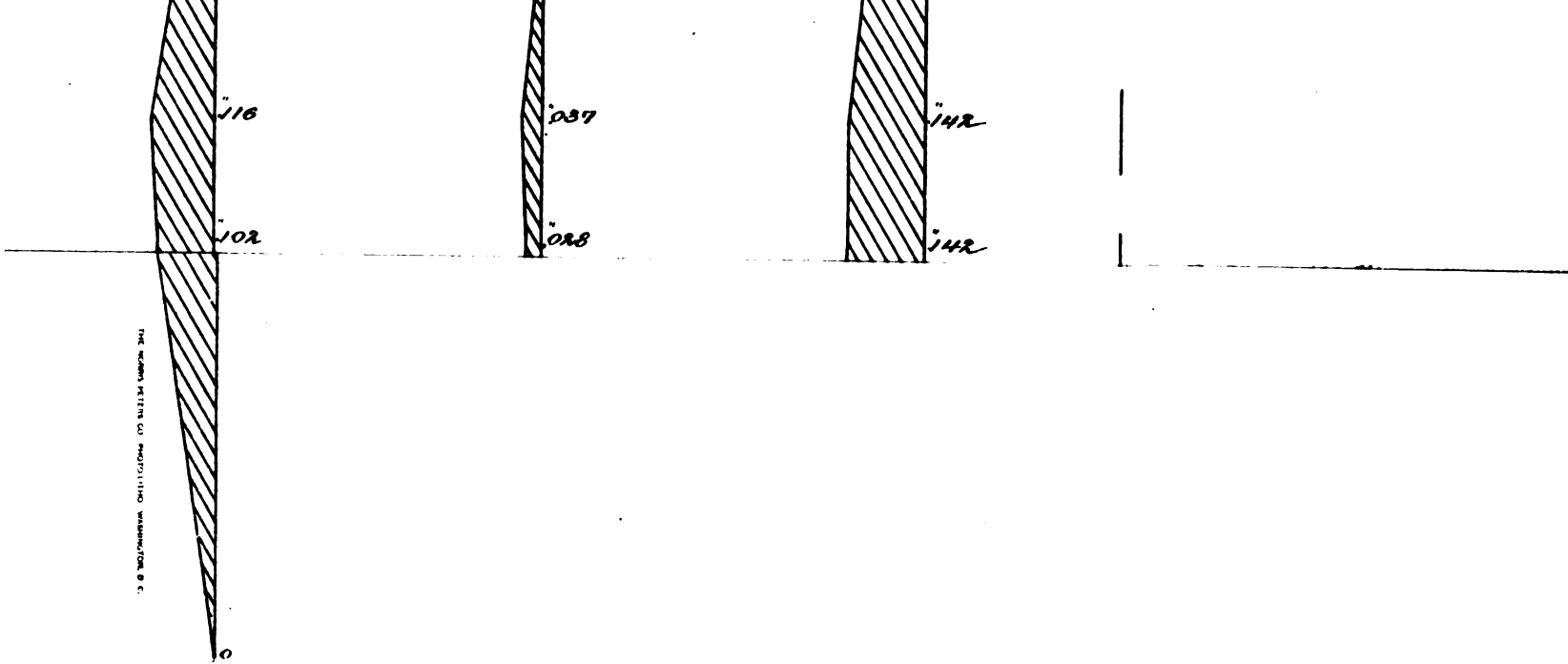
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OOLITIC LIMESTONE FROM BOWLING GREEN STONE COMPANY, LOUISVILLE, KY.

No. 1321.

Length, 23″.95.
Sectional area, 3″.95 × 5″.99 = 23.66 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,366	100	0.	0.	Initial load.
11,830	500	.0018	.....	
23,660	1,000	.0041	.....	
35,490	1,500	.0064	.....	
47,320	2,000	.0089	.....	
35,490	1,500	.0068	.....	
23,660	1,000	.0046	.....	E = 9,290,000 pounds per square inch.
11,830	500	.0023	.....	
2,366	100	.....	.0005	
11,833	500	.0023	.....	
23,660	1,000	.0045	.....	
35,490	1,500	.0068	.....	
47,320	2,000	.0089	.....	
35,490	1,500	.0068	.....	
23,660	1,000	.0046	.....	
11,830	500	.0023	.....	
2,366	100	.....	.0005	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,366	100	0.	0.	Initial load.
47,320	2,000	.0005	.....	
2,366	100	.....	0.	
47,320	2,000	.0005	.....	
2,366	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{4.6}$.
This specimen used in transverse test No. 410.

OOLITIC LIMESTONE FROM BEDFORD, WASHINGTON COUNTY, IND.—BUFF COLOR.

No. 1322.

Length, 23″.92.
Sectional area, 4″.11 × 5″.99 = 23.92 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,462	100	0.	0.	Initial load.
12,310	500	.0010	.....	
24,620	1,000	.0024	.....	
36,930	1,500	.0039	.....	
49,240	2,000	.0053	.....	
61,550	2,500	.0066	.....	
73,860	3,000	.0081	.....	
61,550	2,500	.0066	.....	
49,240	2,000	.0052	.....	
36,930	1,500	.0037	.....	E = 7,100,000 pounds per square inch.
24,620	1,000	.0023	.....	
12,310	500	.0009	.....	
2,462	100	.....	0.	
24,620	1,000	.0022	.....	
49,240	2,000	.0049	.....	
73,860	3,000	.0080	.....	
49,240	2,000	.0050	.....	
24,620	1,000	.0021	.....	
2,462	100	.....	—.0001	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,462	100	0.	0.	Initial load.
73,860	3,000	.0005	.....	
2,462	100	.....	0.	
73,860	3,000	.0005	.....	
2,462	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{4.4}$.
This specimen used in transverse test No. 408.

OOLITIC LIMESTONE FROM BEDFORD, WASHINGTON COUNTY, IND.—BUFF COLOR.

No. 1323.

Length, 24″.06.
Sectional area, 4″.17×5″.98=24.94 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,494	100	0.	0.	Initial load.
12,470	500	.0011	.....	
24,940	1,000	.0025	.....	
37,410	1,500	.0038	.....	
49,880	2,000	.0051	.....	
62,350	2,500	.0067	.....	
74,820	3,000	.0083	.....	
62,350	2,500	.0068	.....	
49,880	2,000	.0053	.....	
37,410	1,500	.0037	.....	E=7,070,000 pounds per square inch.
24,940	1,000	.0026	.....	
12,470	500	.0013	.....	
2,494	100	.....	.0001	
74,820	3,000	.0083	.....	
2,494	100	.....	.0001	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,494	100	0.	0.	Initial load.
74,820	3,000	.0006	.....	
2,494	100	.....	0.	
74,820	3,000	.0006	.....	
2,494	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{3.8}$.
This specimen used in transverse test No. 409.

OOLITIC LIMESTONE FROM BEDFORD, WASHINGTON COUNTY, IND.—BLUE COLOR.

No. 1324.

Length, 24″.04.
Sectional area, 3″.95 × 6″.02 = 23.78 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,378	100	0.	0.	Initial load.
11,890	500	.0009	.....	
23,870	1,000	.0023	.....	
35,670	1,500	.0039	.....	
47,560	2,000	.0053	.....	
59,450	2,500	.0064	.....	
71,340	3,000	.0083	.....	
59,450	2,500	.0067	.....	
47,560	2,000	.0052	.....	
35,670	1,500	.0037	.....	E = 7,250,000 pounds per square inch.
23,870	1,000	.0023	.....	
11,890	500	.0011	.....	
2,378	100	.....	.0003	
71,340	3,000	.0083	.....	
2,378	100	.....	.0003	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,378	100	0.	0.	Initial load.
71,340	3,000	.0006	.....	
2,378	100	.....	0.	
71,340	3,000	.0006+	.....	
2,378	100	.....	.0001	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{3.7}$.
This specimen used in transverse test No. 407.

SLATE FROM MONSON, ME.

No. 1342.

Length, 23″.98.
Sectional area, 4″.04 × 6″.04 = 24.40 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,440	100	0.	0.	Initial load.
24,400	1,000	.0017	.....	
48,800	2,000	.0032	.....	
73,200	3,000	.0047	.....	
97,600	4,000	.0064	.....	
122,000	5,000	.0080	.....	
97,600	4,000	.0066	.....	
73,200	3,000	.0050	.....	
48,800	2,000	.0034	.....	E = 12,250,000 pounds per square inch.
24,400	1,000	.0016	.....	
2,440	100	.....	.0000	

Lateral expansion under endwise compression.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,440	100	0.	0.	Initial load.
122,000	5,000	.0005	.....	
2,440	100	.....	0.	
122,000	5,000	.0005	.....	
2,440	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{4.4}$.

BROWN SANDSTONE FROM CROMWELL, MIDDLESEX COUNTY, CONN.

No. 1326.

Length, 23″.95.
Sectional area, 3″.92×5″.98=23.44 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,344	100	0.	0.	Initial load.
23,440	1,000	.0021	.....	
46,880	2,000	.0049	.....	
70,320	3,000	.0078	.....	
93,760	4,000	.0107	.....	
117,200	5,000	.0137	.....	
93,760	4,000	.0115	.....	
70,320	3,000	.0091	.....	
46,880	2,000	.0064	.....	E=7,711,000 pounds per square inch.
23,440	1,000	.0035	.....	
2,344	100	.....	.0010	
23,440	1,000	.0030	.....	
46,880	2,000	.0055	.....	
70,320	3,000	.0083	.....	
93,760	4,000	.0110	.....	
117,200	5,000	.0137	.....	
93,760	4,000	.0115	.....	
70,320	3,000	.0090	.....	
46,880	2,000	.0064	.....	
23,440	1,000	.0035	.....	
2,344	100	.....	.0010	

Lateral expansion under endwise compression.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,344	100	0.	0.	Initial load.
117,200	5,000	.0008	.....	
2,344	100	.....	0.	
117,200	5,000	.0008	.....	
2,344	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{4.4}$.
This specimen used in transverse test No. 396.

WORCESTER SANDSTONE FROM EAST LONGMEADOW, MASS.

No. 1341.

Length, 24″.07.
Sectional area, 4″.00 × 5″.99 = 23.96 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,396	100	0.	0.	Initial load.
11,980	500	.0101	.....	
23,960	1,000	.0179	.....	
35,940	1,500	.0238	.....	
47,920	2,000	.0289	.....	
35,940	1,500	.0253	.....	
23,960	1,000	.0210	.....	E = 1,780,000 pounds per square inch.
11,980	500	.0153	.....	
2,396	100	.....	.0075	Rested under this load 16 hours.
11,980	500	.0134	.....	
23,960	1,000	.0197	.....	
35,940	1,500	.0249	.....	
47,920	2,000	.0295	.....	
59,900	2,500	.0340	.....	
71,880	3,000	.0384	.....	
59,900	2,500	.0353	.....	
47,920	2,000	.0319	.....	
35,940	1,500	.0279	.....	
23,960	1,000	.0233	.....	
11,980	500	.0174	.....	
2,396	100	.....	.0096	
71,880	3,000	.0389	.....	
2,396	100	.....	.0099	

Lateral expansion under endwise compression.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,396	100	0.	0.	Initial load.
71,880	3,000	.0021	.....	
2,396	100	.....	.0001	
71,880	3,000	.0021	.....	
2,396	100	.....	.0001	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{2.9}$.
This specimen used in transvere test No. 397.

WORCESTER SANDSTONE FROM EAST LONGMEADOW, MASS.

Coefficient of expansion previously determined in water baths.

No. 1350.

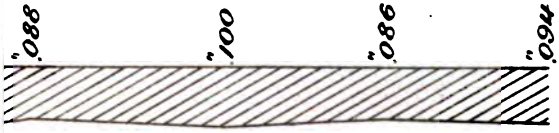
Length, 24″.01.
Sectional area, 4″.00×6″.01=24.04 square inches.
Weight, 45¼ pounds=135.4 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,404	100	0.	0.	Initial load.
12,020	500	.0090	.....	
24,040	1,000	.0166	.....	
36,060	1,500	.0222	.....	
48,080	2,000	.0270	.....	
36,060	1,500	.0237	.....	
24,040	1,000	.0198	.....	E = 1,910,000 pounds per square inch.
12,020	500	.0144	.....	
2,404	100	.....	.0071	
12,020	500	.0124	.....	
24,040	1,000	.0183	.....	
36,060	1,500	.0228	.....	
48,080	2,000	.0271	.....	
36,060	1,500	.0237	.....	
24,040	1,000	.0199	.....	
12,020	500	.0145	.....	
2,404	100	.....	.0075	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5″.5 at middle of length.

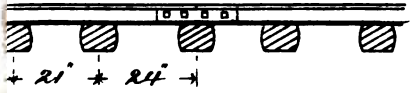
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,404	100	0.	0.	
48,080	2,000	.0008	.....	
2,404	100	.....	0.	
48,080	2,000	.0008	.....	
2,404	100	.....	.0001	
48,080	2,000	.0008	.....	
2,404	100	.....	.0001	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{7.8}$.
This specimen used in transverse test No. 461.



inches from rail.

Shoulder tie plates



in different positions.

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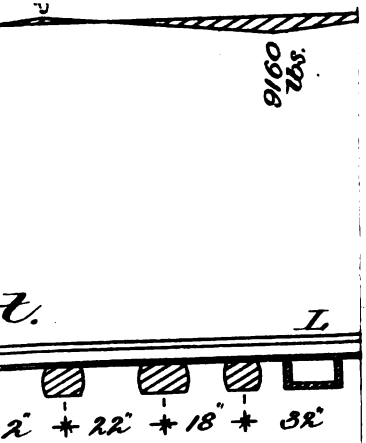

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SANDSTONE FROM CABIN CREEK, JOHNSON COUNTY, ARK.—BLUE STONE.

No. 1329.

Length, 24″.13.
Sectional area, 4″.05×6″.10=24.70 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,470	100	0.	0.	Initial load.
24,700	1,000	.0056	.....	
49,400	2,000	.0125	.....	
74,100	3,000	.0181	.....	
98,800	4,000	.0226	.....	
123,500	5,000	.0269	.....	
98,800	4,000	.0235	.....	
74,100	3,000	.0194	.....	E=3,900,000 pounds per square inch.
49,400	2,000	.0145	.....	
24,700	1,000	.0085	.....	
2,470	100	.....	.0018	
24,700	1,000	.0065	.....	
49,400	2,000	.0124	.....	
74,100	3,000	.0178	.....	
98,800	4,000	.0226	.....	
123,500	5,000	.0269	.....	
98,800	4,000	.0235	.....	
74,100	3,000	.0194	.....	
49,400	2,000	.0145	.....	
24,700	1,000	.0085	.....	
2,470	100	.....	.0019	

Lateral expansion under endwise compression.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,470	100	0.	0.	Initial load.
123,500	5,000	.0005	.....	
2,470	100	.....	0.	
123,500	5,000	.0005	.....	
2,470	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{13.8}$.
This specimen used in transverse test No. 402.

SANDSTONE FROM QUARRIES NEAR FORT SMITH, ARK.—GRAY COLOR.

No. 1330.

Marks, "Jensen, Ark."
Length, 24".02.
Sectional area, 4".43×6".12=27.11 square inches.
Gauged length, 20".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,711	100	0.	0.	Initial load.
27,110	1,000	.0070	.....	
54,220	2,000	.0160	.....	
81,330	3,000	.0233	.....	
108,440	4,000	.0300	.....	
81,330	3,000	.0260	.....	
54,220	2,000	.0211	.....	E=3,530,000 pounds per square inch.
27,110	1,000	.0151	.....	
2,711	100	.....	.0079	
27,110	1,000	.0125	.....	
54,220	2,000	.0188	.....	After sustaining load 1 minute.
		.0189	.....	
81,330	3,000	.0244	.....	
108,440	4,000	.0301	.....	
81,330	3,000	.0261	.....	
54,220	2,000	.0212	.....	
27,110	1,000	.0153	.....	
2,711	100	.....	.0083	

Lateral expansion under endwise compression.
Transverse gauged length, 5".5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,711	100	0.	0.	Initial load.
108,440	4,000	.0004	.....	
2,711	100	.....	.0000½	
108,440	4,000	.0004	.....	
2,711	100	.....	.0000½	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{17.3}$.
This specimen used in transverse test No. 411.

HOTCHKISS 4″.7 RAPID-FIRE GUN.

SPECIMENS FROM EXPLODED BREECH.

DYCKERHOFF'S CEMENT, NEAT—AGE, 10 MONTHS.

No. 1359.

Length, 24″.06.
Sectional area, 4″.03×5″.94=23.94 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,394	100	0.	0.	Initial load.
11,970	500	.0034	.0001	
23,940	1,000	.0073	.0001	
35,910	1,500	.0112	.0003	
47,880	2,000	.0150	.....	
35,910	1,500	.0117	.....	
23,940	1,000	.0080	.....	E = 2,620,000 pounds per square inch.
11,970	500	.0042	.....	
2,394	100	.....	.0005	
11,970	500	.0039	.....	
23,940	1,000	.0078	.....	
35,910	1,500	.0114	.....	
47,880	2,000	.0151	.....	
35,910	1,500	.0117	.....	
23,940	1,000	.0081	.....	
11,970	500	.0042	.....	
2,394	100	.....	.0006	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,394	100	0.	0.	Initial load.
47,880	2,000	.0007	.....	
2,394	100	.....	0.	
47,880	2,000	.0007	.....	
2,394	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{5.7}$.

DYCKERHOFF'S CEMENT, NEAT—AGE, 10 MONTHS.

No. 1360.

Length, 24″.03.
Sectional area, 4″.10 × 5″.89=24.15 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,415	100	0.	0.	Initial load.
12,075	500	.0042	.0003	
24,150	1,000	.0089	.0005	
36,225	1,500	.0136	.0008	
48,300	2,000	.0188	.....	
36,225	1,500	.0148	.....	
24,150	1,000	.0106	.....	E = 2,200,000 pounds per square inch.
12,075	500	.0059	.....	
2,415	100	.....	.0015	
12,075	500	.0055	.....	
24,150	1,000	.0100	.....	
36,225	1,500	.0145	.....	
48,300	2,000	.0189	.....	
36,225	1,500	.0150	.....	
24,150	1,000	.0107	.....	
12,075	500	.0060	.....	
2,415	100	.....	.0016	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,415	100	0.	0.	Initial load.
48,300	2,000	.0009	.....	
2,415	100	.....	0.	
48,300	2,000	.0009	.....	
2,415	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{5.3}$.

PLASTER OF PARIS—AGE, 10 MONTHS.

No. 1361.

Length, 24″.11.
Sectional area, 4″.05×5″.96=24.14 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,414	100	0.	0.	Initial load.
12,070	500	.0160	.0018	
19,200	795	.....	.....	Ultimate strength.

HOTCHKISS 4″.7 RAPID-FIRE GUN.

No. 5308.

Longitudinal side, A.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000200	.000133	.....	.....	
5,000	20,000	.000400	.000200	0.	.....	
6,250	25,000	.000567	.000167	.....	.....	
7,500	30,000	.000833	.000266	0.	.....	
8,750	35,000	.001067	.000234	.....	.....	
10,000	40,000	.001200	.000133	0.	.....	
10,250	41,000	.001233	.000033	.....	.....	
10,500	42,000	.001300	.000067	.....	.....	
10,750	43,000	.001367	.000067	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	Elastic limit.
		.005000	.003567	.....	.....	
11,500	46,000	.005967	.000967	.....	.....	
11,750	47,000	.006600	.000633	.....	.....	
12,000	48,000	.007333	.000733	.....	.....	
12,250	49,000	.008067	.000734	.....	.....	
12,500	50,000	.009000	.000933	.....	.....	
13,000	52,000	.010667	.001667	.....	.....	
13,500	54,000	.012333	.001666	.....	.....	
14,000	56,000	.014167	.001834	.....	.....	
14,500	58,000	.016000	.001833	.....	.....	
15,000	60,000	.018167	.002167	.....	.....	
15,500	62,000	.020667	.002500	.....	.....	
16,000	64,000	.022667	.002000	.....	.....	
16,500	66,000	.025333	.002666	.....	.....	
17,000	68,000	.027667	.002334	.....	.....	
17,500	70,000	.031000	.003333	.....	.....	
18,000	72,000	.033667	.002667	.....	.....	
18,500	74,000	.037000	.003333	.....	.....	
19,000	76,000	.041667	.004667	.....	.....	
19,500	78,000	.046333	.004666	.....	.....	
20,000	80,000	.052667	.006334	.....	.....	
21,000	84,000	.0700	.017333	.....	.....	
22,000	88,000	.0967	.0267	.....	.....	
22,420	89,680	.1500	.0533	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,680
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.001433
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.29 from neck
Character of broken surface		silky
Elongation of inch sections		″.29, ″.27, ″.13

NATURAL STONES.

GRANITE.

Contributed by John S. Braddock, Little Rock, Ark. Quarry located near Little Rock, Pulaski County, Ark.

LIGHT COLORED.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
392	20	4.06	6.11	8,420	1,667	
393	20	4.00	6.03	8,510	1,755	
460	20	4.06	6.03	8,310	1,680	
430	20	3.98	5.99	6,010	1,263	Previously exposed to hot and cold water baths to determine coefficient of expansion.

DARK COLORED.

431	20	4.03	5.98	5,880	1,224	Previously exposed to hot and cold water baths to determine coefficient of expansion.

GRANITE.

Contributed by S. L. Treat & Son, Bar Harbor, Me. Quarries at Millbridge, Me.

LIGHT COLORED.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
391	20	4.12	6.09	10,540	2,069	
424	20	4.13	6.08	10,320	2,027	Previously exposed to hot and cold water baths to determine coefficient of expansion.

GRANITE.

Contributed by J. H. Middendorf, Manchester, Va. From Broad Rock Quarry, Chesterfield County, Va.

LIGHT COLORED.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
427	20	4.00	5.91	7,990	1,672	Previously exposed to hot and cold water baths to determine coefficient of expansion.

No. 5311.

Tangential side, B.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.		
2,500	10,000	.000267	.000200			
5,000	20,000	.000567	.000300	0.		
7,500	30,000	.000933	.000366	0.		
8,750	35,000	.001067	.000134			
10,000	40,000	.001267	.000200	0.		
10,250	41,000	.001300	.000033			
10,500	42,000	.001333	.000033			
10,750	43,000	.001367	.000034			
11,000	44,000	.001400	.000033			
11,250	45,000	.001433	.000033			Elastic limit.
11,500	46,000	.001700	.000267			
11,750	47,000	.003333	.000800			
12,000	48,000	.004133	.000800			
12,250	49,000	.004667	.000534			
12,500	50,000	.005600	.000933			
13,000	52,000	.007167	.001567			
13,500	54,000	.008667	.001500			
14,000	56,000	.010000	.001333			
14,500	58,000	.012000	.002000			
15,000	60,000	.014000	.002000			
15,500	62,000	.016000	.002000			
16,000	64,000	.018000	.002000			
16,500	66,000	.020000	.002000			
17,000	68,000	.022667	.002667			
17,500	70,000	.025000	.002333			
18,000	72,000	.027667	.002667			
18,500	74,000	.030667	.003000			
19,000	76,000	.034000	.003333			
19,500	78,000	.038000	.004000			
20,000	80,000	.041667	.003667			
21,000	84,000	.0567	.015033			
22,000	88,000	.0667	.0100			
22,500	90,000	.0833	.0166			
23,000	92,000	.1167	.0334			
23,040	92,160	.1333	.0166			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	92,160
Elastic limit per square inch of original section	do	45,000
Elongation per inch after rupture	inch	.1333
Elongation per inch under strain at elastic limit	do	.0014
Reduction in diameter at point of rupture	do	.121
Reduction in area after rupture, per cent of original section		37.2
Position of rupture		1″.49 from [illegible]
Character of broken surface		silky
Elongation of inch sections		″.14, ″.32, [illegible].19

BUILDING MATERIAL.

NATURAL STONES, BRICKS, AND CEMENT.

COMPRESSION TESTS, COMPRESSIVE ELASTIC PROPERTIES,
TRANSVERSE TESTS, SHEARING TESTS,

AND

TABLE SHOWING EXPANSION AND CONTRACTION OF STONES,
AND COEFFICIENTS OF EXPANSION.

MARBLE.

Contributed by the Vermont Marble Company, of Proctor, Vt.

RUTLAND WHITE.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
414	20	3.98	5.99	5,720	1,352	
467	20	4.01	6.02	1,410	291	Previously exposed to hot and cold water baths to determine coefficient of expansion.

RUTLAND BLUE.

415	20	4.00	6.00	9,930	2,069	
416	20	3.99	5.98	9,730	2,045	

MOUNTAIN DARK.

417	20	4.00	6.01	10,160	2,109	
451	20	4.02	6.02	6,840	1,408	Previously exposed to hot and cold water baths to determine coefficient of expansion.

SUTHERLAND FALLS.

418	20	4.02	6.01	14,780	3,054	
452	20	4.02	6.03	7,460	1,531	Previously exposed to hot and cold water baths to determine coefficient of expansion.

MARBLE.

Contributed by Dale & Jones, of Little Rock, Ark. Quarry at St. Joe, Searcy County, Ark.

FOSSILIFEROUS.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
421	20	4.10	6.18	8,430	1,615	
454	20	4.08	6.16	2,930	567	Previously exposed to hot and cold water baths to determine coefficient of expansion.

CHOCOLATE COLORED.

422	20	4.02	6.07	8,360	1,603	
423	20	4.01	6.02	7,430	1,534	

MARBLE.

Contributed by Thomas S. Clarkson, of Potsdam, N. Y. Quarries in the town of Dekalb, in St. Lawrence County.

RICHVILLE WHITE.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
420	20	3.91	6.04	5,440	1,144	Previously exposed to hot and cold water baths to determine the coefficient of expansion.
453	20	3.92	6.06	2,560	533	

MARBLE.

Contributed by the Charles River Stone Company, of Boston, Mass.

TUCKAHOE MARBLE FROM TUCKAHOE, N. Y.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
419	20	4.02	6.04	8,740	1,788	

SOUTHERN MARBLE FROM MARBLE HILL, GA.

465	20	4.03	6.04	2,060	604	Previously exposed to hot and cold water baths to determine the coefficient of expansion.
466	20	4.02	6.01	7,120	1,471	

MARBLE.

Contributed by the Georgia Marble Company, of Tate, Pickens County, Ga.

KENNESAW QUARRY.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
455	20	4.00	6.00	6,320	1,317	

ETOWAH QUARRY.

456	20	4.01	6.00	8,610	1,789	

CREOLE QUARRY.

408	20	4.03	6.04	4,060	828	Previously exposed to hot and cold water baths to determine coefficient of expansion.

CHEROKEE QUARRY.

460	20	4.02	6.01	1,850	382	Previously exposed to hot and cold water baths to determine coefficient of expansion.

LIMESTONE.

Contributed by E. R. Goodsell, of Plattsburg, N. Y. Quarries at Isle La Motte, Vermont.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
403	20	4.07	6.11	12,030	2,493	
438	20	4.05	6.10	3,950	786	Previously exposed to hot and cold water baths to determine coefficient of expansion.

LIMESTONE.

Contributed by the Wasioja Stone Company. Quarry located at Wasioja, Dodge County, Minn., on the banks of a branch of the Zumbro River.

GRAY COLOR.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
448	20	6.00	6.08	5,610	253	Previously exposed to hot and cold water baths to determine the coefficient of expansion.

LIMESTONE.

Contributed by John Holmgren, of Junction City, Kans. From Lower quarries, Fort Riley, Kans.

LIGHT BUFF COLOR.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
450	20	4.10	6.15	2,730	528	Previously exposed to hot and cold water baths to determine the coefficient of expansion.

LIMESTONE.

Contributed by Dr. A. G. Lovell, of Mount Vernon, Ky. Quarry located immediately south of the town of Mount Vernon, county of Rockcastle, Ky.

NO. I.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
412	20	4.09	6.07	6,010	1,196	

NO. II.

413	20	4.12	6.05	8,410	1,673	

NO. III.

447	20	4.05	6.08	5,370	1,076	Previously exposed to hot and cold water baths to determine the coefficient of expansion.

LIMESTONE.

Contributed by Bridgford & Duncan. Quarry located at Beaver, Carroll County, Ark.

STONE NO. 1.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
405	20	4.06	6.11	15,270	3,023	
406	20	4.10	6.09	13,710	2,705	

STONE NO. 2.

404	20	4.02	6.12	14,320	2,853	Previously exposed to hot and cold water baths to determine coefficient of expansion.
441	20	4.09	6.06	11,250	2,247	

LIMESTONE.

Darlington oolitic limestone, contributed by the F. L. Fossick Company, of Sheffield, Ala. Quarries and mills at Rockwood, Ala.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
446	20	3.98	6.02	3,320	690	Previously exposed to hot and cold water baths to determine the coefficient of expansion.

LIMESTONE.

Oolitic limestone, contributed by the Bowling Green Stone Company, of Louisville, Ky.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
410	20	3.95	5.99	6,220	1,317	Previously exposed to hot and cold water baths to determine coefficient of expansion.
445	20	3.93	6.01	3,780	799	

LIMESTONE.

Oolitic limestone from the Salem-Bedford Stone Company, of Louisville, Ky. From quarries at Bedford, Washington County, Ind.

BLUE COLOR.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
407	20	3.95	6.02	8,910	1,867	
444	20	3.95	6.00	4,540	956	Previously exposed to hot and cold water baths to determine coefficient of expansion.

BUFF COLOR.

408	20	4.11	5.99	9,630	1,962	
409	20	4.17	5.98	10,710	2,155	

SANDSTONE.

Contributed by the New England Brownstone Company, of Cromwell, Conn.

BROWN COLOR.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
396	20	3.92	5.98	10,480	2,243	
433	20	3.94	5.97	7,020	1,500	Previously exposed to hot and cold water baths to determine coefficient of expansion.

The following table, prepared from the detailed observations on the stones during the coefficient of expansion determinations, shows the amount of swelling displayed by the different stones in passing from the cold-water bath at 32° F. through the hot-water bath at 212° F. and back again to the temperature 32° F. in the cold water.

The amount of swelling stated in the table refers to the total amount which occurred on the stones within the gauged length of 20 inches.

Specimens in sealed cases were exposed to the same range of temperature as the other stones, but were not in contact with the water of the baths.

GRANITES.

Description.	Amount of permanent swelling.
	Inch.
From Braddock quarries, near Little Rock, Ark. (light)	.0048
From Braddock quarries, near Little Rock, Ark. (dark)	.0024
From Millbridge, Me., White Rock Mountain	.0032
From Broad Rock quarry, Chesterfield County, Va	.0047
From Korah Station, Va	.0048
From Exeter, Tulare County, Cal	.0019
From Rockville, Stearns County, Minn	.0061
From Sioux Falls, Minn	.0050
From Troy, N. H.	.0021
From Branford, Conn	.0043
From Milford, Mass.	.0033
	.0071
From Milford, Mass. (in sealed case)	.0017
Mean	.0040

MARBLES.

Rutland white, Vermont	.0135
Rutland white, Vermont (second exposure)	.0029
Mountain Dark, Vermont	.0084
Sutherland Falls, Vt	.0107
From St. Joe, Searcy County, Ark	.0196
From De Kalb, St. Lawrence County, N. Y	.0055
From Marble Hill, Ga	.0077
From Marble Hill, Ga. (in sealed case)	.0057
Mean	.0090

LIMESTONES.

From Isle La Motte, Vermont	.0081
From Wasioja, Minn	.0024
From Fort Riley, Kans	.0052
From Beaver, Carroll County, Ark	.0060
From Mount Vernon, Ky	.0075
From Darlington quarry, Rockwood, Ill	.0114
From Bowling Green, Ky	.0077
From Bedford, Washington County, Ind.	.0119
	.0025
Mean	.0070

SANDSTONE.

Contributed by the Minneapolis Trust Company, of Minneapolis, Minn. From Kettle River Quarry, at Sandstone, Pine County, Minn.

SALMON COLOR.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
434	20	3.94	5.99	4,090	868	Previously exposed to hot and cold water baths to determine coefficient of expansion.

SANDSTONE.

Contributed by the Arkansas Stone Company, of Little Rock, Ark. Quarries at Cabin Creek, Johnson County, Ark.

BLUE STONE.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
403	20	4.05	6.10	4,470	890	
439	20	4.05	6.03	11,990	2,442	Previously exposed to hot and cold water baths to determine the coefficient of expansion.

SANDSTONE.

Contributed by Ed. McKenna. Quarries near Fort Smith, Sebastian County, Ark. Stones marked "Jenson, Ark."

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
411	20	4.25	6.12	9,340	1,761	
449	20	4.45	6.15	6,650	1,185	Previously exposed to hot and cold water baths to determine coefficient of expansion.

The fragments of the transverse specimens when subsequently tested by compression generally showed a loss in strength in the halves which were wet, these having been immersed in water for a period of one week.

The mean of all the wet samples were found to possess 85 per cent the strength of the dry ones. While 15 per cent represents the mean loss, an examination of the results shows that individually the loss may range from zero to about 35 per cent.

Furthermore, it may be seen that the greatest loss in strength occurred in medium hard and in hard brick, but not all hard brick were affected alike in this respect.

COMPRESSIVE STRENGTH OF WET AND DRY HALVES OF THE SAME BRICK.

Manufacturers.	Description.	Compressive strength per square inch.		
		Dry.	Wet.	Loss.
		Pounds.	*Pounds.*	*Pounds.*
Gay Head Clay and Brick Co., Chelsea, Mass.	Buff	5,774	4,900	874
	do	5,570	5,346	224
	Buff speckled	6,481	5,063	1,418
	Fire brick	2,639	2,321	318
	do	2,346	2,118	228
New England Steam Brick Co., Providence, R. I.	Light red, No. 0	5,874	4,506	1,368
	Red, No. 1	5,777	4,506	1,271
	Red, No. 2	7,888	8,917	—1,029
	Red, No. 3	10,624	10,482	142
	Red, No. 4	11,353	8,088	3,265
	Red, No. 5	9,671	9,674	—3
	Dark buff, No. 51	5,855	4,503	1,352
	Press, light chocolate, No. 63.	4,447	3,181	1,266
	Light hard, water struck.	5,601	4,530	1,071
	Hard body	9,655	6,230	3,425
	Light buff, No. 55	3,599	3,289	310
	Paving	10,712	9,902	810
The Powhatan Clay Manufacturing Co., Richmond, Va.	Cream white, No. 1	4,929	4,142	787
	Dark red, No. 2	10,391	9,600	791
	Light red, No. 3	16,019	14,822	1,197
	Cream white, No. 4	4,447	4,052	395
	do	4,530	3,796	734
The Coaldale Brick and Tile Co., Coaldale, Ala.	Vitrified paving, A	15,842	11,273	4,569
John Eharker, Ashby, Ala	Fire, No. 1	2,414	1,885	529
The A. O. Jones Brick and Terra Cotta Co., Zanesville, Ohio.	Vitrified paving block.	11,942	7,941	4,001
Kansas City Hydraulic Press Brick Co., Kansas City, Mo.	Red, No. 1	18,072	11,911	6,161
	Red, No. 2	12,000	12,652	—652
Monticello Brick Works, Monticello, Minn.	Face, No. 2	16,018	15,611	407
A. Humphrey, Minneapolis, Minn	Light chocolate, No. 71.	7,724	7,037	687
Pacific Clay Manufacturing Co., Los Angeles, Cal.		2,973	2,778	195
Mean		8,039	6,835	1,204
Relative strength per cent		100	85	15

Within limits the strength of bricks increases with the hardness to which they are burned, and commonly the moduli of elasticity increase with the hardness of the material. The strength and rigidity, as shown by the modulus of elasticity, also appear to vary inversely as the amount of water absorbed.

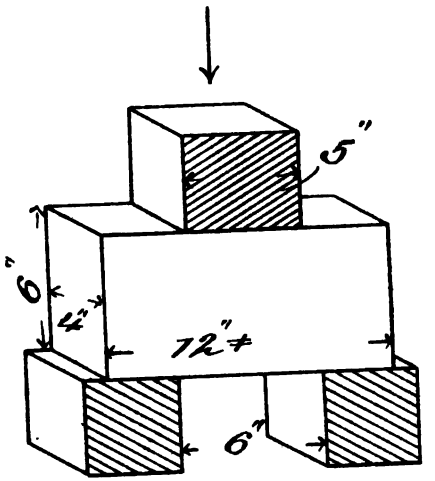
GENERAL DESCRIPTION.

Kind of stone.	Color.	Quarry.	State.	Town or county.	Age since quarried.	Contributor.
					Months.	
Granite	Light and dark		Arkansas	Near Little Rock, Pulaski County.		John S. Braddock, Little Rock, Ark.
Do		White Rock Mountain	Maine	Millbridge		S. L. Treat & Son, Bar Harbor, Me.
Do	Light	Broad Rock	Virginia	Chesterfield County		J. H. Middendorf, Manchester, Va.
Do	do		do	Korah Station		Richmond Granite Co., Richmond, Va.
Do	do		California	Exeter, Tulare County	9	Rocky Point Granite Works, Exeter, Cal.
Do	Mottled		Minnesota	Stearns County	6	Rockville Granite Co., Rockville, Minn.
Do	Gray and red		do	Sioux Falls		Drake Company, St. Paul, Minn.
Do	Gray		New Hampshire	Troy		Charles River Stone Co., Boston, Mass.
Do	Pink		Connecticut	Branford		Do.
Do	Pinkish white		Massachusetts	Milford		Do.
Jasper			Minnesota	Sioux Falls		Drake Company, St. Paul, Minn.
Marble	White		Vermont	Rutland		Vermont Marble Co., Proctor, Vt.
Do	Blue		do	do		Do.
Do		Mountain Dark	do			Do.
Do		Sutherland Falls	do			Do.
Do	Chocolate		Arkansas	St. Joe, Searcy County	6	Dale & Jones, Little Rock, Ark.
Do	White	Richville	New York	DeKalb, St. Lawrence Co	5	Thos. S. Clarkson, Potsdam, N. Y.
Do	do		Georgia	Marble Hill		Charles River Stone Co., Boston, Mass.
Do	White crystalline		New York	Tuckahoe		Do.
Do	White clouded with gray.	Creole	Georgia	Tate		Georgia Marble Co., Tate, Ga.
Do	do	Cherokee	do	do		Do.
Do	Pink	Etowah	do	do		Do.
Do	White	Kennesaw	do	do		Do.
Limestone			Vermont	Isle La Motte	4	E. R. Goodsell, Plattsburg, N. Y.
Do	Gray and buff		Minnesota	Wasioja, Dodge County		Wasioja Stone Co.
Do	Light buff		Kansas	Junction City and Fort Riley		John Holmgren, Junction City, Kans.
Do	Drab		Kentucky	Mount Vernon	9	Dr. A. G. Lovell, Mount Vernon, Ky.
Do	Gray		Arkansas	Beaver, Carroll County	6	Bridgford & Duncan.
Limestone, Oolitic	Light gray	Darlington	Alabama	Rockwood	7	The F. L. Fossick Co., Sheffield, Ala.
Do	do		Kentucky	Bowling Green		Bowling Green Stone Co., Louisville, Ky.
Do	Buff and blue		Indiana	Bedford, Washington County		Salem-Bedford Stone Co., Louisville, Ky.
Slate	Blue		Maine	Monson		
Sandstone	Brown		Connecticut	Cromwell, Middlesex County	26	New England Brown Stone Co., Cromwell, Conn.
Do	do	Worcester	Massachusetts	East Longmeadow		Charles River Stone Co., Boston, Mass.
Do	Red	Kibbe	do	do		Do.
Do	do	Maynard	do	do		Do.
Do	Blue		Alabama	Walker County	16	Jasper Stone Quarry Co., Jasper, Ala.
Do	Salmon	Kettle River	Minnesota	Pine County	5	Minneapolis Trust Co., Minneapolis, Minn.
Do	Blue	Cabin Creek	Arkansas	Johnson County		Arkansas Stone Co., Little Rock, Ark.

NATURAL STONES.

SHEARING TESTS.

Tests of Stones.



Shearing tests.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

NATURAL STONES.

GRANITE.

Contributed by John S. Braddock, of Little Rock, Ark. Quarry located near Little Rock, Pulaski County, Ark.

LIGHT COLORED.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
	Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
306	3.98×5.95×2	47.36	34,000	102,700	2,168	One.
307	3.99×5.93×2	47.32	29,000	95,050	2,009	One.

DARK COLORED.

308	4.02×5.98×2	48.08	41,600	117,200	2,438	One.

GRANITE.

Contributed by S. L. Treat & Son, of Bar Harbor, Me. Quarries at Millbridge, Me.

LIGHT COLORED.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
	Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
309	4.02×5.99×2	48.16	43,800	135,800	2,820	One.

GRANITE.

Contributed by J. H. Middendorf, of Manchester, Va., from Broad Rock quarry, Chesterfield County, Va.

LIGHT COLORED.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
	Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
300	4.05×5.98×2	48.44	29,900	100.050	2,065	One.

NATURAL STONES.

COMPRESSION TESTS.

LIMESTONE.

Contributed by the Wasioja Stone Company. Quarry located at Wasioja, Dodge County, Minn., on the banks of a branch of the Zumbro River.

GRAY COLOR.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
	Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
315	6.10×6.02×2	73.44	30,500	87,100	1,186	One.

BUFF COLOR.

316	6.01×5.77×2	69.35	28,800	75,200	1,084	One.

LIMESTONE.

Contributed by John Holmgren, Junction City, Kans. From Lower quarries, Fort Riley, Kans.

LIGHT BUFF COLOR.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
	Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
313	4.13×6.15×2	50.18	20,300	56,200	1,120	One.
314	4.12×6.12×2	50.43	16,000	48,300	958	One.
471	4.21×6.19×2	52.12	19,000	51,500	988	One.

LIMESTONE.

Contributed by Bridgford & Duncan. Quarry located at Beaver, Carroll County, Ark.

No. of test.	Marks.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
					Total.	Per square inch.	
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
282	No. 1	4.16×6.00×2	49.92	32,800	81,900	1,641	One.
283	No. 1	4.10×5.99×2	49.12	32,900	104,100	2,119	One.
284	No. 2	4.03×6.00×2	48.36	30,800	105,400	2,179	Two.
285	No. 2	4.08×6.10×2	49.78	28,100	102,300	2,053	One.

LIMESTONE.

Darlington oolitic limestone, contributed by the F. L. Fossick Company, of Sheffield, Ala. Quarries and mills at Rockwood, Ala.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
	Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
265	4.02×5.96×2	47.92	27,000	46,900	978	Two.

LIMESTONE.

Oolitic limestone contributed by the Bowling Green Stone Company, of Louisville, Ky.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
	Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
266	4.00×5.96×2	47.68	18,200	59,950	1,257	Two.
267	3.95×6.00×2	47.40	26,400	55,200	1,164	Two.

LIMESTONE.

Oolitic limestone from the Salem-Bedford Stone Company, of Louisville, Ky. From quarries at Bedford, Washington County, Ind.

BUFF COLOR.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
	Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
269	3.99×5.98×2	47.72	24,100	57,600	1,207	Two.
270	3.96×5.99×2	47.44	23,300	58,700	1,237	Two.

BLUE COLOR.

268	3.94×5.98×2	47.12	23,500	44,200	938	One.
271	3.95×6.00×2	47.40	26,900	51,900	1,095	One.

GRANITE.

Contributed by the Richmond Granite Company, of Richmond, Va. Quarries at Korah Station.

LIGHT-COLORED.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
7498	No. 3.	*Inches.* 4.03	*Inches.* 3.99	*Inches.* 4.00	*Sq. in.* 15.96	*Pounds.* 307,000	*Pounds.* 374,200	*Pounds* 23,446

GRANITE.

Contributed by the Rocky Point Granite Works, of Exeter, Tulare County, Cal.

LIGHT-COLORED.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7499	4.00	3.99	4.08	16.28	82,000	331,600	20,368
7500	4.01	4.02	4.02	16.16	312,000	399,900	24,746

GRANITE.

Contributed by Rockville Granite Company, of Rockville, Minn. Location of quarry, section 9, township 123, range 29, Stearns County, Minn.

COARSE MOTTLED GRANITE.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7501	4.03	4.15	4.08	16.93	178,000	321,000	18,960
7502	4.05	4.02	4.12	16.56	165,000	286,200	17,282

GRANITE AND JASPER.

Contributed by the Drake Company, of St. Paul, Minn.

GRAY GRANITE.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7413	3.97	3.95	3.98	15.72	148,000	289,300	18,403

RED GRANITE.

7503	3.98	4.02	3.94	15.84	117,500	284,300	17,948

JASPER.

7504	3.90	3.85	3.92	15.09	186,000	420,200	27,846

MARBLE.

Contributed by the Vermont Marble Company, of Proctor, Vt.

RUTLAND WHITE MARBLE.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7456	3.98	4.00	4.02	16.08	189,800	189,800	11,803
7457	4.00	4.00	4.00	16.00	191,700	191,700	11,981

RUTLAND BLUE MARBLE.

7458	4.00	4.01	4.01	16.08	259,000	261,100	16,238
7459	3.98	3.98	3.98	15.84	182,000	182,000	11,490

MOUNTAIN DARK MARBLE.

7460	4.02	4.01	4.01	16.08	205,500	205,500	12,780
7461	4.00	4.01	4.01	16.08	207,200	207,200	12,886

SUTHERLAND FALLS MARBLE.

7462	4.01	4.02	4.03	16.20	255,000	267,400	16,506
7463	4.01	4.01	4.02	16.12	254,800	254,800	15,806

MARBLE.

From the Dale and Jones quarries, St. Joe, Searcy County, Ark.

FOSSILIFEROUS MARBLE.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7465	4.10	4.10	4.13	16.93	164,000	171,500	10,130
7466	4.08	4.11	4.10	16.85	173,000	175,100	10,393
7467	4.06	4.13	4.10	16.93	173,000	176,300	10,413

CHOCOLATE-COLORED MARBLE.

7468	4.10	4.09	4.04	16.52	198,000	206,400	12,494
7469	4.05	4.06	4.08	16.56	143,000	227,900	13,762
7470	4.10	4.10	4.10	16.81	93,000	177,800	10,577

MARBLE.

Richville white marble from De Kalb, St. Lawrence County, N. Y. Contributed by Thomas S. Clarkson, Potsdam, N. Y.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7181	4.11	4.07	4.08	16.61	228,100	228,100	13,733
7182	3.83	4.02	4.16	16.72	169,000	175,200	10,478
7183	3.89	4.15	4.04	16.77	182,000	201,300	12,004
7464	4.10	3.76	4.02	15.11	208,100	208,100	13,772

LIMESTONE.

Contributed by E. R. Goodsell, of Plattsburg, N. Y. Quarries at Isle La Motte, Vermont.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7495	4.01	4.02	3.98	16.00	72,000	218,600	13,662
7496	4.00	4.00	4.00	16.00	91,000	249,300	15,581

LIMESTONE.

Contributed by the Wasioja Stone Company. Quarry located at Wasioja, Dodge County, Minn., on the banks of a branch of the Zumbro River.

BUFF COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7481	3.98	4.10	4.08	16.73	31,000	67,400	4,029

GRAY COLOR.

7482	4.10	4.10	4.08	16.73	70,000	83,900	5,014

LIMESTONE.

Contributed by John Holmgren, Junction City, Kans.

JUNCTION CITY WHITE ROCK.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7700	3.98	4.00	3.88	15.52	44,000	46,500	2,996
7701	3.93	3.87	3.98	15.40	51,000	51,600	3,350

LIMESTONE.

Contributed by Bridgford & Duncan. Quarry located at Beaver, Carroll County, Ark.

GRAY COLOR.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7489	No. 1....	3.98	4.13	4.14	17.10	320,000	346,800	20,281
7490	No. 1....	4.07	4.14	4.10	16.97	301,000	363,100	21,397
7491	No. 2....	4.02	4.13	4.15	17.14	130,000	343,900	20,064

EXPANSION OF STONES.

TABLE SHOWING THE EFFECT OF TREATMENT OF STONES IN WATER AND AIR AT DIFFERENT TEMPERATURES.

Description of stone.			Treatment.	Temperature.	Gauged length.	Coefficient of expansion.
Name.	Location of quarry.	Owner.				
				° F.	*Inches.*	*Inch.*
Granite, light stone	Near Little Rock, Ark	John S. Braddock, Little Rock, Ark.	Open air	65	19.9939	
			Snow 22 hours	32	19.9927	
			Cold water 47 hours	32	19.9930	
			Hot water	212	20.0101	.00000341
			Cold water	32	19.9978	
Granite, dark stone	do	do	Open air	65	20.0057	
			Snow 22 hours	32	20.0136	
			Cold water 43 hours	32	20.0136	
			Hot water	212	20.0270	
			Cold water	32	20.0142	
			Hot water	212	20.0277	.00000324
			Cold water	32	20.0160	
Granite, "White Rock Mountain."	Millbridge, Me	S. L. Treat & Son, Bar Harbor, Me.	Open air	65	20.0040	
			Cold water	33	20.0026	
			Hot water	212	20.0202	.00000400
			Cold water	32	20.0058	
			Out of doors 16 hours	−4 to +6	20.0047	
Granite, light broad rock	Chesterfield County, Va	J. H. Middendorf, Manchester, Va.	Open air	65	20.0070	
			Snow 16 hours	30	20.0061	
			Cold water 45 hours	32	20.0054	
			Hot water	212	20.0246	.00000402
			Cold water	32	20.0101	
Granite, light	Korah Station, Va	Richmond Granite Co., Richmond, Va.	Open air	65	19.9937	
			Snow 22 hours	32	19.9928	
			Cold water 42 hours	32	19.9937	
			Hot water	212	20.0131	.00000431
			Cold water	32	19.9976	
Do	Exeter, Tulare County, Cal	Rocky Point Granite Works, Exeter, Cal.	Open air	65	19.9922	
			Snow 16 hours	30	19.9919	
			Cold water 18 hours	32	19.9925	
			Hot water	212	20.0110	.00000461
			Cold water	32	19.9944	
Granite, mottled	Rockville, Stearns County, Minn	Rockville Granite Co., Rockville, Minn.	Open air	65	19.9970	
			Snow 16 hours	30	19.9970	
			Cold water 21 hours	32	19.9904	
			Hot water	212	20.0168	.00000307
			Cold water	32	20.0025	
Granite, red	Sioux Falls, Minn	Drake Co., St. Paul, Minn	Open air	65	19.9869	

			Snow 22 hours	32	19.9804	
			Out of doors over night	29	19.9808	
			Cold water 18 hours	32	19.9812	
			Hot water	212	20.0011	.00000389
			Cold water	32	19.9871	
Granite, gray	Troy, N. H	Charles River Stone Co., Boston, Mass.	Open air	75	20.0050	
			Water bath 4 days	69	20.0070	
			Cold water	34	20.0061	
			Hot water 5 hours	209	20.0200	.00000337
			Cold water 6 hours	34	20.0082	
Granite, pink	Branford, Conn	do	Open air	70	20.0046	
			Water bath 8 days	67	20.0057	
			Cold water	34	20.0046	
			Hot water 6 hours	211	20.0230	.00000398
			Cold water	34	20.0089	
Granite, pinkish white	Milford, Mass	do	Open air	70	20.0004	
			Water bath 6 days	70	20.0019	
			Cold water 16 hours	34	20.0006	
			Hot water	211	20.0174	
			Cold water 7 hours	34	20.0039	
			Open air 1 month	83	20.0048	
			Heated in oven to 406° F. 2 hours.	406	20.0441	
			Cooled in oven	86	20.0101	
			Open air 8 days	83	20.0102	
			Open air 22 days	88	20.0103	
			Water bath 17 days	83	20.0104	
			Open air 6 days, cold water 7 hours.	34	20.0077	
			Hot water	212	20.0226	.00000418
Do	do	do	Cold water	34	20.0077	
			In hermetically sealed brass case while in open air and in baths. Stone not in contact with water:			
			Open air	90	20.0150	
			Cold water 6 hours	34	20.0120	
			Cold water 22 hours	34	20.0122	
			Hot water 6 hours	212	20.0287	.00000415
			Cold water	34	20.0139	
Marble, white	Rutland, Vt	Vermont Marble Co., Proctor, Vt	Open air	80	19.9919	
			Cold water	34	19.9916	
			Hot water	212	20.0183	
			Cold water	34	20.0051	
			Hot air	402	20.0609	
			Cooled in hot-air tank	82	20.0228	
			Cold water	34	20.0209	
			Hot water	212	20.0349	.00000312
			Cold water	34	20.0238	
Marble, mountain dark	Vermont	do	Open air	65	20.0041	
			Snow 22 hours	32	20.0043	
			Cold water 46 hours	32	20.0040	

SANDSTONE.

Contributed by the Arkansas Stone Company, of Little Rock, Ark. Quarries at Cabin Creek, Johnson County, Ark.

BLUE STONE.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7492	4.03	3.95	4.08	16.12	105,000	318,300	19,746
7493	4.00	4.03	4.01	16.16	108,000	289,600	17,921
7494	4.02	4.03	4.07	16.40	206,000	290,900	17,738

SANDSTONE.

Stone contributed by Ed. McKenna. Quarries near Fort Smith, Sebastian County, Ark. Stones marked "Jensen, Ark."

GRAY COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7830	10.50	4.09	3.96	16.20	151,000	187,600	11,580
7831	11.07	4.08	4.04	16.48	120,500	229,900	13,950

"BANDERA" SANDSTONE.

Contributed by The Bandera Flagstone Company, of Redfield, Kans. Quarries near Redfield, Bourbon County, Kans., about 11 miles west of Fort Scott, Kans.

BLUE COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7485	3.94	4.01	3.98	15.96	134,800	134,800	8,446
7486	3.93	3.98	3.96	15.76	119,900	119,900	7,608

SANDSTONE.

Contributed by W. F. Myers, San Francisco, Cal. From the Piedmont quarry, located about 5½ miles from Oakland, Alameda County, Cal.

BLUE COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7613	4.10	4.03	4.11	16.56	169,000	195,600	11,812
7614	4.04	4.04	4.12	16.64	62,000	182,900	10,991
7615	4.05	4.08	4.07	16.61	167,000	171,400	10,319

SANDSTONE.

From R. S. Littlefield, of Bandore, Coos County, Oreg. Stones marked Coquille River, Coos County, Oreg.

BLUE COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7414	3.90	3.98	4.08	16.24	147,100	147,100	9,057
7415	4.03	4.00	4.12	16.48	133,000	137,400	8,337
7416	3.97	4.00	3.85	15.40	72,000	76,200	4,948

NOTE.—No. 7416 was tested wet, after 22 hours immersion in water. After fracture the stone indicated that the water had penetrated to a depth of about five-eighths of an inch below the surfaces of the cube.

SANDSTONE.

Contributed by the Tenino Stone Quarry Company, of Tenino, Thurston County, Wash.

GRAYISH GREEN COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7418	4.02	4.00	4.05	16.20	108,400	108,400	6,691
7419	4.01	4.00	4.05	16.20	106,380	106,380	6,567
7420	4.02	3.98	4.04	16.08	109,440	109,440	6,806

Table showing the effect of treatment of stones in water and air at different temperatures—Continued.

Description of stone.			Treatment.	Temperature.	Gauged length.	Coefficient of expansion.
Name.	Location of quarry.	Owner.				
				° *F.*	*Inches.*	*Inch.*
Sandstone, Kibbe red	East Longmeadow, Mass	Charles River Stone Co., Boston, Mass.	Open air	75	20.0108	
			Water bath 54 hours	68	20.0193	
			Cold water	34	20.0162	
			Water bath 24 hours	67	20.0198	
			Hot water	209	20.0393	.00000577
			Cold water 16 hours	34	20.0191	
Sandstone, Maynard red	do	do	Open-air	74	20.0075	
			Hot-air tank 2 hours	402	20.0573	
			Cooled in air	89	20.0123	
			Open air 21 days	88	20.0116	
			Water bath 17 days	83	20.0128	
			Cold bath 17 hours	34	20.0077	
			Hot water 5 hours	212	20.0282	.00000567
Do	do	do	Cold water 6 hours	34	20.0080	
			In hermetically sealed brass case in open air and in baths; stone not in contact with water:			
			Open air	82	20.0146	
			Cold water 7 hours	34	20.0102	
			Hot water 6 hours	212	20.0319	.00000555
			Cold water 7 hours	34	20.0121	
Sandstone, Kettle River, salmon.	Pine County, Minn	Minneapolis Trust Co., Minneapolis, Minn.	Open air	65	19.9992	
			Snow 22 hours	30	19.9954	
			Cold water 22 hours	32	19.9952	
			Hot water	212	20.0217	.00000686
			Cold water; 2″ of gauged length in frozen water.	32	19.9970	
			Hot water	212	20.0214	
Sandstone, Cabin Creek, blue.	Johnson County, Ark	Arkansas Stone Co., Little Rock, Ark.	Open air	68	20.0068	
			Snow 16 hours	27	20.0025	
			Cold water 40 hours	32	20.0033	
			Hot water	212	20.0272	.00000613
			Cold water	32	20.0051	
Sandstone, gray	Sebastian County, Ark	Ed. McKenna, Fort Smith, Ark	Open air	68	19.9916	
			Snow 16 hours	27	19.9883	
			Cold water, 40 hours	32	19.9932	
			Hot water	212	20.0162	
			Cold water; 2″ of gauged length in frozen water.	32	19.9942	

Sandstone, "Bandera"	Bourbon County, Kans	Bandera Flagstone Co., Redfield, Kans.	Hot water	212	20.0170	.00000620
			Cold water	32	19.9947	
			Open air	65	20.0173	
			Snow 22 hours	30	20.0138	
			Cold water 22 hours	32	20.0159	
Sandstone, Piedmont, blue	Alameda County, Cal	Wm. F. Myers, San Francisco, Cal.	Hot water	212	20.0362	.00000516
			Cold water	32	20.0176	
			Open air	68	19.9869	
			Snow 16 hours	27	19.9837	
			Cold water 23 hours	32	19.9880	
Sandstone, Cooper	Douglas County, Oreg	Jos. G. Kelley, Roseburg, Oreg	Hot water	212	20.0211	.00000436
			Cold water	32	20.0054	
			Open air	65	20.0441	
			Heated in water bath to 212° F. each day and allowed to cool each night for a period of 30 days: Water bath	68	20.0896	
			Heated in water bath to 212° F. each day and allowed to cool each night for a period of 12 days: Cooled in hot water bath	74	20.0908	
			Frozen out of doors while in saturated state.	20	20.1096	
			Out of doors 24 hours after above freezing.	10	20.1096	
			Cold water 16 hours	32	20.1072	
			Hot water	212	20.1114	
			Cold water	32	20.1067	
			Hot air furnace, ends of stone cooler.	530	20.1238	
			Cooled in hot air furnace	62	20.0832	
Sandstone, Olympia, blue	Olympia, Wash	Geo. E. Huggins, Olympia, Wash	Open air	80	20.0061	
			Water bath	73	20.0143	
			Cold water 7 hours	34	20.0130	
			Hot water 6 hours. Allowed to cool.	212		
			Hot water 4 hours	212	20.0279	.00000320
			Cold water 24 hours	34	20.0165	
Sandstone, Chuckanut, blue	Chuckanut, Wash	Henry Roeder, New Whatcomb, Wash.	Open air	65	20.0006	
			Snow 40 hours	27	19.9983	
			Cold water 42 hours	32	20.0017	
			Hot water	212	20.0203	
			Cold water; 2" of gauged length in frozen water.	32	20.0060	
			Hot water	212	20.0211	.00000394
			Cold water	32	20.0069	

SANDSTONE.

Contributed by William F. Myers, of San Francisco, Cal. From the Piedmont quarry, located about 5½ miles from Oakland, Alameda County, Cal.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
310	*Inches.* 4.00×5.99×2	*Sq. in.* 48.64	*Pounds.* 26,200	*Pounds.* 79,100	*Pounds.* 1,626	One.

SANDSTONE.

Contributed by R. S. Littlefield, of Bandore, Coos County, Oreg. Stones marked "Coquille River, Coos Co., Oregon."

BLUE COLOR.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
292	*Inches.* 4.00×5.95×2	*Sq. in.* 47.60	*Pounds.* 19,900	*Pounds.* 59,400	*Pounds.* 1,248	One.

SANDSTONE.

Contributed by George E. Huggins, of Olympia, Wash. From the Olympia sandstone quarry, Olympia, Thurston County, Wash.

BLUE COLOR.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
293	*Inches.* 4.01×5.99×2	*Sq. in.* 48.04	*Pounds.* 27,500	*Pounds.* 75,100	*Pounds.* 1,563	One.
294	4.04×6.00×2	48.48	33,700	83,500	1,722	One.

SANDSTONE.

Contributed by Henry Roeder, of New Whatcom, Wash. Bellingham Bay stone, Chuckanut quarries.

BLUE COLOR.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
	Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
291	4.18×6.29×2	52.58	34,400	95,100	1,809	One.

SANDSTONE.

Contributed by the Tenino Stone Quarry Company, of Tenino, Thurston County, Wash.

BLUE COLOR.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
	Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
289	4.00×5.96×2	47.68	25,900	50,700	1,063	One.
290	3.97×5.95×2	47.24	26,500	65,600	1,389	Two.

EXPANSION OF STONES.

TABLE SHOWING THE EFFECT OF TREATMENT OF STONES IN WATER AND AIR AT DIFFERENT TEMPERATURES.

Description of stone.			Treatment.	Temperature.	Gauged length.	Coefficient of expansion.
Name.	Location of quarry.	Owner.				
				° *F.*	*Inches.*	*Inch.*
Granite, light stone	Near Little Rock, Ark	John S. Braddock, Little Rock, Ark.	Open air	65	19.9939	
			Snow 22 hours	32	19.9927	
			Cold water 47 hours	32	19.9930	
			Hot water	212	20.0101	.00000341
			Cold water	32	19.9978	
Granite, dark stone	do	do	Open air	65	20.0057	
			Snow 22 hours	32	20.0136	
			Cold water 43 hours	32	20.0136	
			Hot water	212	20.0270	
			Cold water	32	20.0142	
			Hot water	212	20.0277	.00000324
			Cold water	32	20.0160	
Granite, "White Rock Mountain."	Millbridge, Me	S. L. Treat & Son, Bar Harbor, Me.	Open air	65	20.0040	
			Cold water	33	20.0026	
			Hot water	212	20.0202	.00000400
			Cold water	32	20.0058	
			Out of doors 16 hours	−4 to +6	20.0047	
Granite, light broad rock	Chesterfield County, Va	J. H. Middendorf, Manchester, Va.	Open air	65	20.0070	
			Snow 16 hours	30	20.0061	
			Cold water 45 hours	32	20.0054	
			Hot water	212	20.0246	.00000402
			Cold water	32	20.0101	
Granite, light	Korah Station, Va	Richmond Granite Co., Richmond, Va.	Open air	65	19.9937	
			Snow 22 hours	32	19.9928	
			Cold water 42 hours	32	19.9937	
			Hot water	212	20.0131	.00000431
			Cold water	32	19.9976	
Do	Exeter, Tulare County, Cal	Rocky Point Granite Works, Exeter, Cal.	Open air	65	19.9922	
			Snow 16 hours	30	19.9919	
			Cold water 18 hours	32	19.9925	
			Hot water	212	20.0110	.00000401
			Cold water	32	19.9944	
Granite, mottled	Rockville, Stearns County, Minn	Rockville Granite Co., Rockville, Minn.	Open air	65	19.9970	
			Snow 16 hours	30	19.9970	
			Cold water 21 hours	32	19.9984	
			Hot water	212	20.0168	.00000397
			Cold water	32	20.0025	
Granite, red	Sioux Falls, Minn	Drake Co., St. Paul, Minn	Open air	65	19.9969	

			Snow 22 hours	32	19.9804	
			Out of doors over night	29	19.9808	
			Cold water 18 hours	32	19.9812	
			Hot water	212	20.0011	.00000389
			Cold water	32	19.9871	
Granite, gray	Troy, N. H	Charles River Stone Co., Boston, Mass.	Open air	75	20.0050	
			Water bath 4 days	69	20.0070	
			Cold water	34	20.0061	
			Hot water 5 hours	209	20.0200	.00000337
			Cold water 6 hours	34	20.0082	
Granite, pink	Branford, Conn	do	Open air	70	20.0046	
			Water bath 8 days	67	20.0057	
			Cold water	34	20.0046	
			Hot water 6 hours	211	20.0230	.00000398
			Cold water	34	20.0089	
Granite, pinkish white	Milford, Mass	do	Open air	70	20.0004	
			Water bath 6 days	70	20.0019	
			Cold water 16 hours	34	20.0006	
			Hot water	211	20.0174	
			Cold water 7 hours	34	20.0039	
			Open air 1 month	83	20.0048	
			Heated in oven to 406° F. 2 hours.	406	20.0441	
			Cooled in oven	86	20.0101	
			Open air 8 days	83	20.0102	
			Open air 22 days	88	20.0103	
			Water bath 17 days	83	20.0104	
			Open air 6 days, cold water 7 hours.	34	20.0077	
			Hot water	212	20.0226	.00000418
Do	do	do	Cold water	34	20.0077	
			In hermetically sealed brass case while in open air and in baths. Stone not in contact with water:			
			Open air	90	20.0150	
			Cold water 6 hours	34	20.0120	
			Cold water 22 hours	34	20.0122	
			Hot water 6 hours	212	20.0287	.00000415
			Cold water	34	20.0139	
Marble, white	Rutland, Vt	Vermont Marble Co., Proctor, Vt	Open air	80	19.9919	
			Cold water	34	19.9916	
			Hot water	212	20.0183	
			Cold water	34	20.0051	
			Hot air	402	20.0609	
			Cooled in hot-air tank	82	20.0228	
			Cold water	34	20.0209	
			Hot water	212	20.0349	.00000312
			Cold water	34	20.0238	
Marble, mountain dark	Vermont	do	Open air	65	20.0041	
			Snow 22 hours	32	20.0043	
			Cold water 46 hours	32	20.0040	

Table showing the effect of treatment of stones in water and air at different temperatures—Continued.

Description of stone.			Treatment.	Temperature.	Gauged length.	Coefficient of expansion.
Name.	Location of quarry.	Owner.		° F.	*Inches.*	*Inch.*
Marble, mountain dark	Vermont	Vermont Marble Co., Proctor, Vt.	Hot water	212	20.0260	.00000433
			Cold water	32	20.0104	
Marble	Sutherland Falls, Vt.	do	Open air	65	20.0010	
			Snow 22 hours	32	19.9997	
			Cold water	32	20.0007	
			Hot water	212	20.0312	.00000550
			Cold water	32	20.0114	
Marble, fossiliferous	St. Joe, Searcy County, Ark.	Dale & Jones, Little Rock, Ark.	Open air	65	19.9943	
			Snow 22 hours	30	19.9932	
			Cold water	32	19.9935	
			Hot water	212	20.0210	.00000219
			Cold water	32	20.0131	
Marble, Richville white	Dekalb, St. Lawrence County, N. Y.	Thos. S. Clarkson, Potsdam, N. Y.	Open air	65	19.9855	
			Snow 22 hours	30	19.9825	
			Cold water	32	19.9832	
			Hot water	212	20.0115	.00000634
			Cold water	32	19.9887	
Marble, white	Marble Hill, Ga.	Charles River Stone Co., Boston, Mass.	Open air	75	20.0041	
			Water bath 48 hours	70	20.0063	
			Cold water 6 hours	34		
			Hot water 4 hours	209.3	20.0211	.00000202
			Cold water 5 hours	33.8	20.0140	
Do	do	do	In hermetically sealed brass case while in open air and in baths. Stone not in contact with water:			
			Open air	70	19.9988	
			Cold water 6 hours	34	19.9996	
			Cold water 22 hours	34	19.9994	
			Hot water 6 hours	212	20.0117	.00000185
			Cooled in water	81	20.0047	
			Cold water	34	20.0051	
Marble, Cherokee	Tate, Ga.	Georgia Marble Co., Tate, Ga.	Open air	78	20.0355	
			Cold water 24 hours	34	20.0351	
			Hot water 6 hours	212	20.0505	.00000441
Limestone	Isle LaMotte, Vt.	E. R. Goodsell, Plattsburg, N. Y.	Cold water 7 hours	34	20.0348	
			Open air	68	20.0014	
			Snow 16 hours	27	19.9968	
			Cold water 22 hours	32	19.9980	
			Hot water	212	20.0159	.00000219
			Cold water	32	20.0077	

Limestone, gray	Wasioja, Dodge County, Minn.	Wasioja Stone Co.	Open air	65		19.9944	
			Snow 16 hours	30		19.9949	
			Cold water 22 hours	32		19.9961	
			Hot water	212		20.0163	.00000217
			Cold water	32		19.9985	
Limestone, light buff	Fort Riley, Kans	John Holmgren, Junction City, Kans.	Open air	68		19.9810	
			Snow 16 hours	27		19.9791	
			Cold water 22 hours	32		19.9798	
			Hot water	212		19.9958	.00000300
			Cold water	32		19.9850	
Limestone, gray	Beaver, Carroll County, Ark.	Bridgford & Duncan	Open air	68		20.0158	
			Snow 16 hours	27		20.0123	
			Cold water 40 hours	32		20.0133	
			Hot water	212		20.0363	.00000471
			Cold water	32		20.0193	
Limestone, drab	Mount Vernon, Ky.	Dr. A. G. Lovell, Mount Vernon, Ky.	Open air	75		20.0000	
			Cold water 18 hours	34		19.9957	
			Hot water 2 hours	208		20.0184	
			Cooled in water bath	68	20.0185		.00000464
			Hot water 5 hours	190			
			Cold water 10 hours	34		20.0032	
Limestone, Darlington	Rockwood, Ala	The F. L. Fossick Co., Sheffield, Ala.	Open air	65		19.9870	
			Snow 16 hours	30		19.9864	
			Cold water	32		19.9864	
			Hot water	212		19.9999	.00000058
			Cold water	32		19.9978	
Limestone, light gray	Bowling Green, Ky.	Bowling Green Stone Co., Louisville, Ky.	Open air	65		20.0038	
			Snow 16 hours	30		20.0049	
			Cold water 22 hours	32		20.0039	
			Hot water	212		20.0148	.00000089
			Cold water	32		20.0116	
Limestone, blue	Bedford, Washington County, Ind.	Salem-Bedford Stone Co., Louisville, Ky.	Open air	65		19.9990	
			Snow 14 hours	30		19.9981	
			Cold water 17 hours	33		19.9978	
			Hot water	212		20.0230	
			Cold water; 2" of gauged length in frozen water.	33		20.0097	
			Hot water	212		20.0262	.00000389
			Cold water	32		20.0122	
Sandstone, brown	Cromwell, Conn	New England Brown Stone Co., Cromwell, Conn.	Open air	65		20.0088	
			Snow 40 hours	27		20.0046	
			Cold water	32		20.0055	
			Hot water	212		20.0188	.00000544
			Cold water	32		20.0182	
Sandstone, Worcester brown	East Longmeadow, Mass	Charles River Stone Co., Boston, Mass.	Open air	75		20.0107	
			Water bath, 7 days	68		20.0162	
			Cold water 16 hours	34		20.0140	
			Hot water 5 hours	211		20.0345	.00000517
			Cold water 8 hours	34		20.0162	

a Earlier experiments made on this stone and published in report of 1894.

Table showing the effect of treatment of stones in water and air at different temperatures—Continued.

Description of stone.			Treatment.	Temperature.	Gauged length.	Coefficient of expansion.
Name.	Location of quarry.	Owner.				
				° *F.*	*Inches.*	*Inch.*
Sandstone, Kibbe red	East Longmeadow, Mass	Charles River Stone Co., Boston, Mass.	Open air	75	20.0108	
			Water bath 54 hours	68	20.0193	
			Cold water	34	20.0162	
			Water bath 24 hours	67	20.0198	
			Hot water	209	20.0393	.00000577
			Cold water 16 hours	34	20.0191	
Sandstone, Maynard red	do	do	Open air	74	20.0075	
			Hot-air tank 2 hours	402	20.0573	
			Cooled in air	89	20.0123	
			Open air 21 days	88	20.0116	
			Water bath 17 days	83	20.0128	
			Cold bath 17 hours	34	20.0077	
			Hot water 5 hours	212	20.0282	.00000567
Do	do	do	Cold water 6 hours	34	20.0080	
			In hermetically sealed brass case in open air and in baths; stone not in contact with water:			
			Open air	82	20.0146	
			Cold water 7 hours	34	20.0102	
			Hot water 6 hours	212	20.0319	.00000555
			Cold water 7 hours	34	20.0121	
Sandstone, Kettle River, salmon.	Pine County, Minn	Minneapolis Trust Co., Minneapolis, Minn.	Open air	65	19.9992	
			Snow 22 hours	30	19.9954	
			Cold water 22 hours	32	19.9952	
			Hot water	212	20.0217	.00000686
			Cold water; 2" of gauged length in frozen water.	32	19.9970	
			Hot water	212	20.0214	
Sandstone, Cabin Creek, blue.	Johnson County, Ark	Arkansas Stone Co., Little Rock, Ark.	Open air	68	20.0068	
			Snow 16 hours	27	20.0025	
			Cold water 40 hours	32	20.0033	
			Hot water	212	20.0272	.00000613
			Cold water	32	20.0051	
Sandstone, gray	Sebastian County, Ark	Ed. McKenna, Fort Smith, Ark	Open air	68	19.9916	
			Snow 16 hours	27	19.9883	
			Cold water, 40 hours	32	19.9932	
			Hot water	212	20.0162	
			Cold water; 2" of gauged length in frozen water.	32	19.9942	

Sandstone, "Bandera"	Bourbon County, Kans	Bandera Flagstone Co., Redfield, Kans.	Hot water	212	20.0170	.00000620
			Cold water	32	19.9947	
			Open air	65	20.0173	
			Snow 22 hours	30	20.0138	
			Cold water 23 hours	32	20.0159	
Sandstone, Piedmont, blue	Alameda County, Cal	Wm. F. Myers, San Francisco, Cal.	Hot water	212	20.0362	.00000516
			Cold water	32	20.0176	
			Open air	68	19.9869	
			Snow 16 hours	27	19.9837	
			Cold water 23 hours	32	19.9880	
Sandstone, Cooper	Douglas County, Oreg	Jos. G. Kelley, Roseburg, Oreg	Hot water	212	20.0211	.00000436
			Cold water	32	20.0054	
			Open air	65	20.0441	
			Heated in water bath to 212° F. each day and allowed to cool each night for a period of 30 days: Water bath	68	20.0896	
			Heated in water bath to 212° F. each day and allowed to cool each night for a period of 12 days: Cooled in hot water bath	74	20.0908	
			Frozen out of doors while in saturated state.	20	20.1096	
			Out of doors 24 hours after above freezing.	10	20.1096	
			Cold water 16 hours	32	20.1072	
			Hot water	212	20.1114	
			Cold water	32	20.1067	
			Hot air furnace, ends of stone cooler.	530	20.1238	
			Cooled in hot air furnace	62	20.0832	
Sandstone, Olympia, blue	Olympia, Wash	Geo. E. Huggins, Olympia, Wash.	Open air	80	20.0061	
			Water bath	73	20.0143	
			Cold water 7 hours	34	20.0130	
			Hot water 6 hours. Allowed to cool.	212		
			Hot water 4 hours	212	20.0279	.00000320
			Cold water 24 hours	34	20.0105	
Sandstone, Chuckanut, blue	Chuckanut, Wash	Henry Roeder, New Whatcomb, Wash.	Open air	65	20.0006	
			Snow 40 hours	27	19.9983	
			Cold water 42 hours	32	20.0017	
			Hot water	212	20.0203	
			Cold water; 2″ of gauged length in frozen water.	32	20.0060	
			Hot water	212	20.0211	.00000394
			Cold water	32	20.0069	

Table showing the effect of treatment of stones in water and air at different temperatures—Continued.

Description of stone.			Treatment.	Temperature.	Gauged length.	Coefficient of expansion.
Name.	Location of quarry.	Owner.				
				° *F.*	*Inches.*	*Inch.*
Sandstone, blue	Thurston County, Wash.	The Tenino Stone Quarry Co., Tenino, Wash.	Open air	66	19.9999	
			Snow 40 hours	27	19.9975	
			Cold water 20 hours	32	20.0055	
			Hot water	212	20.0336	
			Cold water; 2″ of gauged length in frozen water.	32	20.0203	
			Hot water	212	20.0363	.00000347
			Cold water	32	20.0238	

GRANITE FROM TROY, N. H.

No. 1344.

engtb, 24″.04.
ectional area, 4″.09×6″.09=24.91 square inches.
auged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,491	100	0.	0.	Initial load.
24,910	1,000	.0068	.....	
49,820	2,000	.0133	.....	
74,730	3,000	.0176	.....	
99,640	4,000	.0212	.....	
124,550	5,000	.0245	.....	
99,640	4,000	.0219	.....	
74,730	3,000	.0191	.....	E=4,800,000 pounds per square inch.
49,820	2,000	.0157	.....	
24,910	1,000	.0113	.....	
2,491	100	.....	.0041	
24,910	1,000	.0092	.....	
49,820	2,000	.0141	.....	
74,730	3,000	.0180	.....	
99,640	4,000	.0213	.....	
124,550	5,000	.0245	.....	
99,640	4,000	.0219	.....	
74,730	3,000	.0191	.....	
49,820	2,000	.0157	.....	
24,910	1,000	.0113	.....	
2,491	100	.....	.0042	

Lateral expansion under endwise compression.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,491	100	0.	0.	Initial load.
124,550	5,000	.0007	.....	
2,491	100	.....	0.	
124,550	5,000	.0007	.....	
2,491	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{8}$.
This specimen used in transverse test No. 390.

NATURAL STONES, CEMENT, AND PLASTER OF PARIS.

TABULATION OF RESULTS OF COMPRESSION, TRANSVERSE, AND SHEARING TESTS, AND COEFFICIENTS OF EXPANSION IN WATER.

Name of stone.		No. of test.	Compressive strength per square inch.	Transverse strength, modulus of rupture per square inch.	Shearing strength per square inch.	Weight per cubic foot.	Compressive modulus of elasticity per square inch.	Ratio of lateral expansion to longitudinal compression.	Coefficient of expansion in water.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		*Inch.*
Granite from Braddock quarries, near Little Rock, Ark.	Light	7168	22,388						
		7169	20,025						
		7170	18,577						
		7171	17,407						
		1349				156.2	6,090,000	$\frac{1}{5.5}$	
		1333					6,950,000	$\frac{1}{4.8}$	
		1334					8,160,000	$\frac{1}{4.7}$	
		392		1,667					
		393		1,755					
		460		1,689					
		430		1,263					.00000341
		306			2,168				
		307			2,009				
	Dark	7172	24,653						
		7173	20,363						
		7174	27,518						
		431		1,224					.00000324
		308			2,438				
Granite from Millbridge, Me., "White Rock Mountain"		7403	23,558						
		7404	16,673						
		7405	19,519						
		1332					9,800,000	$\frac{1}{5.8}$	
		391		2,069					
		424		2,027					.00000400
		309			2,820				
Granite from Broad Rock quarry, Chesterfield County, Va		7497	15,350						
		427		1,672					.00000402
		300			2,065				
Granite from Korah Station, Va		7498	23,446						
		426		1,608					.00000431
		301			2,662				
Granite from Exeter, Tulare County, Cal		7499	20,308						
		7500	24,749						.00000481
		432		1,853					
		302			2,419				

Granite from Rockville, Stearns County, Minn	7501	18,960						
	7502	17,282						
	1335					9,420,000	$\frac{1}{2.7}$	
	394		1,428					
	428		1,230					.00000397
	303			1,930				
	304			1,967				
Granite from Sioux Falls, Minn	7413	18,403						
	7503	17,948						
	1336					6,010,000	$\frac{1}{4.3}$	
	395		1,378					
	429		1,053					.00000389
	305			2,086				
Granite from Troy, N. H	1344					4,800,000	$\frac{1}{5}$	
	390		2,385					
	425		2,002					.00000337
Granite from Branford, Conn	1345					6,710,000	$\frac{1}{3.7}$	
	1348				161.1	4,610,000	$\frac{1}{11.8}$	.00000398
	389		1,415					
	459		1,083					
Granite from Milford, Mass	1346					5,830,000	$\frac{1}{7.1}$	.00000415
	1347				162.9	4,680,000	$\frac{1}{14.3}$	.00000418
	458		1,545					
Jasper from Sioux Falls, Minn	7504	27,846						
Rutland white marble from Vermont	7456	11,808						
	7457	11,981						
	1313					5,270,000	$\frac{1}{5.3}$	
	1356				167.6	3,640,000	$\frac{1}{4.6}$	.00000312
	414		1,202					
	467		291					
	272			1,100				
	273			946				
	7458	16,238						
	7459	11,490						
Rutland blue marble from Vermont	1314					6,500,000 7,800,000	$\frac{1}{2.6}$	
	1318					7,500,000	$\frac{1}{2.5}$	
	415		2,069					
	416		2,045					
	274			1,519				
	275			914				
Mountain dark marble from Vermont	7460	12,780						
	7461	12,886						
	1315					9,290,000	$\frac{1}{3.1}$	
	417		2,109					
	451		1,408					.00000433
	276			1,431				
	277			1,475				

Tabulation of results of compression, transverse, and shearing tests, and coefficients of expansion in water—Continued.

Name of stone.	No. of test.	Compressive strength per square inch.	Transverse strength, modulus of rupture per square inch.	Shearing strength per square inch.	Weight per cubic foot.	Compressive modulus of elasticity per square inch.	Ratio of lateral expansion to longitudinal compression.	Coefficient of expansion in water.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		*Inch.*
Sutherland Falls marble from Vermont	7462	16,506						
	7463	15,806						
	1316					12,580,000	$\frac{1}{4}$	
	418		3,054					
	452		1,531					.00000550
	278			2,010				
	279			1,119				
Fossiliferous marble from St. Joe, Searcy County, Ark	7465	10,130						
	7466	10,393						
	7467	10,413						
	1319					8,210,000	$\frac{1}{7}$	
	421		1,615					
	454		567					.00000219
Chocolate marble from St. Joe, Searcy County, Ark	7468	12,494						
	7469	13,762						
	7470	10,577						
	1320					10,740,000	$\frac{1}{7}$	
	422		1,693					
	423		1,534					
Richville white marble from Dekalb, St. Lawrence County, N. Y.	7181	13,733						
	7182	10,478						
	7183	12,004						
	7464	13,772						
	1317					12,000,000	$\frac{1}{8}$	
	420		1,144					
	453		533					.00000634
Marble from Marble Hill, Ga.	1354				167.7	4,480,000	$\frac{1}{16}$	
	1355				167.8	6,550,000	$\frac{1}{8}$	
	465		604					.00000202
	466		1,471					.00000185
Marble from Tate, Ga.: Creole quarry	1357				169	4,060,000	$\frac{1}{8}$	
	468		828					
Cherokee quarry	1358				168.4	3,980,000	$\frac{1}{8}$	
	469		382					.00000441
Etowah quarry	456		1,789					
Kennesaw quarry	455		1,317					

Limestone, from Isle LaMotte, Vt		7495	13,662					
		7496	15,581					
		1331				14,720,000	$\frac{1}{5}\frac{1}{6}$	
		403		2,493				
		438		786				.00000219
		298			1,946			
		299			2,400			
Limestone, from Wasioja, Dodge County, Minn	Buff color	7481	4,029					
		316			1,084			
	Gray color	7482	5,014					
		448		253				.00000217
		315			1,186			
Limestone, from Junction City, Kans		7700	2,996					
		7701	3,350					
		450		528				.00000300
Limestone, from Fort Riley, Kans		313			1,120			
		314			958			
		471			988			
Limestone from Beaver, Carroll County, Ark		7489	20,281					
		7490	21,397					
		7491	20,064					
		1327				6,530,000	$\frac{1}{4}\frac{1}{6}$	
		1328				6,760,000	$\frac{1}{4}\frac{1}{4}$	
		405		3,023				
		406		2,705				
		404		2,853				
		441		2,247				.00000471
		282			1,641			
		283			2,119			
		284			2,179			
		285			2,053			
Limestone from Mount Vernon, Ky		1343				4,000,000	$\frac{1}{4}\frac{1}{3}$	
		412		1,196				
		413		1,673				
		447		1,076				.00000464
Limestone from Rockwood, Ala		7471	5,752					
		7472	6,162					
		446		690				.00000058
		265			978			
Limestone from Bowling Green, Ky		7473	6,008					
		7474	6,077					
		1321				9,290,000	$\frac{1}{4}\frac{1}{5}$	
		410		1,317				
		445		799				.00000089
		266			1,257			
		267			1,164			

Tabulation of results of compression, transverse, and shearing tests, and coefficients of expansion in water—Continued.

Name of stone.		No. of test.	Compressive strength per square inch.	Transverse strength, modulus of rupture per square inch.	Shearing strength per square inch.	Weight per cubic foot.	Compressive modulus of elasticity per square inch.	Ratio of lateral expansion to longitudinal compression.	Coefficient of expansion in water.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		*Inch.*
Limestone from Bedford, Washington County, Ind.	Buff color	7475	10,446						
		7476	9,129						
		7477	7,462						
		1322					7,160,000	$\frac{1}{4.6}$	
		1323					7,070,000	$\frac{1}{3.8}$	
		408		1,962					
		409		2,155					
		269			1,207				
		270			1,237				
	Blue color	7478	11,636						
		7479	11,247						
		7480	9,586						
		1324					7,250,000	$\frac{1}{3.7}$	
		407		1,867					
		444		958					.00000389
		268			938				
		271			1,095				
Slate from Monson, Me.		1342					12,250,000	$\frac{1}{4.4}$	
Sandstone from Cromwell, Conn.		7483	17,557						
		7484	16,231						
		1326					7,711,000	$\frac{1}{4.2}$	
		396		2,243					
		433		1,500					.00000540
		287			1,601				
		288			1,450				
Sandstone from East Longmeadow, Mass.	Worcester	1341					1,780,000	$\frac{1}{5.9}$	
		1350				135.4	1,910,000	$\frac{1}{7.2}$	.00000517
		397		987					
		461		1,189					
	Kibbe	1340					2,200,000	$\frac{1}{3}$	
		1351				134.	1,100,000	$\frac{1}{4.4}$	.00000577
		398		1,273					
		462		655					
	Maynard	1352				132.7	1,200,000	$\frac{1}{5.0}$	.00000567
		1353				132.9	1,300,000	$\frac{1}{4.9}$	.00000555
		463		660					
		464		884					

Sandstone from Jasper, Ala.	7820	16,570					
	7821	16,620					
	7822	13,700					
	457		1,889				
	470			2,202			
Sandstone from Kettle River, Pine County, Minn.	7487	12,295					
	7488	12,799					
	434		868				.00000686
	280			1,478			
	281			1,632			
Sandstone from Cabin Creek, Johnson County, Ark.	7492	19,746					
	7493	17,921					
	7494	17,738					
	1329				3,900,000	1$\frac{1}{16}$	
	402		890				.00000613
	439		2,442				
	295			2,549			
	296			2,291			
	297			2,597			
Sandstone quarried near Fort Smith, Sebastian County, Ark.	7830	11,580					
	7831	13,950					
	1330				3,530,000	1$\frac{7}{16}$	
	411		1,761				
	449		1,185				.00000620
	311			2,035			
	312			1,338			
	472			1,921			
Sandstone quarried near Redfield, Bourbon County, Kans.	7485	8,446					
	7486	7,608					
	440		2,088				.00000516
	296			1,940			
Sandstone from Piedmont quarry, near Oakland, Alameda County, Cal.	7613	11,812					
	7614	10,991					
	7615	10,319					
	437		1,063				.00000436
	310			1,626			
Sandstone from Coquille River, Coos County, Oreg.	7414	9,057					
	7415	8,337					
	7416	4,948					
	292			1,248			
Sandstone from Cooper quarry, Douglas County, Oreg.	1337				2,164,000	1$\frac{1}{16}$	
	443		724				.00000177
Sandstone from Olympia, Wash.	1338				3,277,000	$\frac{1}{2}$	
	399		2,073				
	442		2,297				.00000320
	293			1,563			
	294			1,722			
Sandstone from Chuckanut, Wash.	1339				2,120,000	1$\frac{1}{16}$	
	400		2,016				
	436		961				.00000394
	291			1,809			

Table showing the effect of treatment of stones in water and air at different temperatures—Continued.

Description of stone.			Treatment.	Temperature.	Gauged length.	Coefficient of expansion.
Name.	Location of quarry.	Owner.				
				° *F.*	*Inches.*	*Inch.*
Sandstone, blue	Thurston County, Wash	The Tenino Stone Quarry Co., Tenino, Wash.	Open air	65	19.9999	
			Snow 40 hours	27	19.9975	
			Cold water 20 hours	32	20.0055	
			Hot water	212	20.0336	
			Cold water; 2″ of gauged length in frozen water.	32	20.0203	
			Hot water	212	20.0363	.00000347
			Cold water	32	20.0238	

CHEMICAL ANALYSES OF NATURAL STONES, BRICKS, AND TILE.

Name of stone.	SiO_2.	Fe_2O_3.	Al_2O_3.	CaO.	MgO.	Na_2O.	K_2O.	SO_3.	P_2O_5.	TiO_2.	CO_2.	MnO.	Loss on ignition.	Loss.
Granite:														
Broad Rock Quarry, Chesterfield County, Va.	80.00	2.77	15.50	1.02	0.15								0.48	0.08
Korah Station, Va.	71.98	1.34	16.63	2.15	0.10	3.15	4.62							
Exeter, Tulare County, Cal.	75.35	3.94	13.69	2.97	0.06	1.14	2.85							
Rockville, Stearns County, Minn.	72.55	2.20	15.92	2.67	0.13	2.50	4.03							
Sioux Falls red, Minnesota	70.10	3.15	16.93	1.63	0.09	0.76	7.32							
Jasper:														
Sioux Falls, Minn.	98.41	1.42		0.17	Trace.									
Marble:														
Rutland white, Vermont	1.78	0.86		53.05	1.95			0.55			41.79			
Rutland blue, Vermont	0.63	0.22		55.26	0.18			Trace.			43.65			
Sutherland Falls, Vt.	1.63	0.25		54.41	0.62						43.00			
Fossiliferous, St. Joe, Ark.	1.42	2.95		53.30	0.20				0.01		42.08			
Richville white, De Kalb, N. Y.	4.04		1.64	33.91	16.49						43.92			
Limestone:														
Isle LaMotte, Vt	1.29	1.12		54.56	0.18			Trace.			42.87			
Wasioja, Dodge County, Minn.	4.97	1.49		8.07	37.60						47.83			
Darlington, Rockwood, Ill	0.50	1.45		54.20	1.23						42.61			
Bedford, Washington County, Ind.—														
Blue	1.15	1.91		53.25	1.24						42.40			
Buff	0.77	0.63	3.00	52.85	1.18						41.54			
Junction City, Kans.	3.06		4.53	51.70	0.56						40.14			
Beaver, Carroll County, Ark	10.46	1.25		27.97	18.33						41.05			
Sandstone:														
New England Brown, Cromwell, Conn.	62.47	3.65	10.70	10.25	0.53	2.20	4.15				6.00			
Jasper, Ala.	78.58	2.54	15.19	None.	0.65						3.00			
Kettle River, Pine County, Minn.	97.10		2.20	0.60	0.10									
Cabin Creek, Johnson County, Ark	91.56	1.25	5.88	0.70	0.20							0.18		
Bandera, Redfield, Kans.	77.32	3.40	9.45	2.00	Trace.	2.72	0.67				4.30	0.16		
Piedmont, Alameda County, Cal.	70.29	3.91	16.61	3.01							3.00			
Coquille River, Coos County, Oreg	60.35	6.86	25.00	3.12	2.13					1.54	0.90	0.10		
Tenino, Thurston County, Wash.	67.25	4.57	18.81	6.13	0.10						3.04			
Bricks:														
Bay State Brick Co., Boston, Mass., hard burnt, red	62.10	9.65	20.35	7.82	0.12									
Brush & Schmidt, Buffalo, N. Y., pressed brick, No. 2	68.50	6.86	21.55	3.04	0.09									
Superior Brick Co., Rockford, Ill., hard burnt, No. 1	55.25	3.63	20.02	19.30	1.75									
Tile:														
American Encaustic Tiling Co., N. Y., white, 5006 G	62.70	trace.	35.48	1.65	0.15									

NATURAL STONES, CEMENT, AND PLASTER OF PARIS.

TABULATION OF RESULTS OF COMPRESSION, TRANSVERSE, AND SHEARING TESTS, AND COEFFICIENTS OF EXPANSION IN WATER.

Name of stone.		No. of test.	Compressive strength per square inch.	Transverse strength, modulus of rupture per square inch.	Shearing strength per square inch.	Weight per cubic foot.	Compressive modulus of elasticity per square inch.	Ratio of lateral expansion to longitudinal compression.	Coefficient of expansion in water.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		*Inch.*
Granite from Braddock quarries, near Little Rock, Ark.	Light	7168	22,388						
		7169	20,025						
		7170	18,577						
		7171	17,407						
		1349				156.2	6,090,000	$\frac{1}{19}$	
		1333					6,950,000	$\frac{1}{18}$	
		1334					8,160,000	$\frac{1}{17}$	
		392		1,667					
		393		1,755					
		460		1,689					
		430		1,263					.00000341
		306			2,168				
		307			2,000				
	Dark	7172	24,653						
		7173	20,363						
		7174	27,518						
		431		1,224					.00000324
		308			2,438				
Granite from Millbridge, Me., "White Rock Mountain"		7403	23,558						
		7404	16,673						
		7405	19,519						
		1332					9,800,000	$\frac{1}{8}$	
Granite from Broad Rock quarry, Chesterfield County, Va.		391		2,069					
		424		2,027					.00000400
		300			2,820				
		7497	15,350						
		427		1,672					.00000402
		300			2,065				
Granite from Korah Station, Va.		7498	23,446						
		426		1,608					.00000431
		301			2,662				
Granite from Exeter, Tulare County, Cal.		7499	20,368						
		7500	24,746						.00000481
		432		1,853					
		302			2,419				

Granite from Rockville, Stearns County, Minn	7501	18,960						
	7502	17,282						
	1335					9,420,000	$\frac{1}{7}$	
	394		1,428					
	428		1,230					.00000397
	303			1,930				
	304			1,967				
Granite from Sioux Falls, Minn	7413	18,403						
	7503	17,948						
	1336					6,010,000	$\frac{1}{7.5}$	
	395		1,378					
	429		1,053					.00000389
	305			2,086				
Granite from Troy, N. H	1344					4,800,000	$\frac{1}{9}$	
	390		2,335					
	425		2,002					.00000837
Granite from Branford, Conn	1345					6,710,000	$\frac{1}{8.7}$	
	1348				161.1	4,610,000	$\frac{1}{11.3}$	.00000398
	389		1,415					
	459		1,083					
Granite from Milford, Mass	1346					5,830,000	$\frac{1}{7.3}$	.00000415
	1347				162.9	4,680,000	$\frac{1}{11.3}$	.00000418
	458		1,545					
Jasper from Sioux Falls, Minn	7504	27,846						
Rutland white marble from Vermont	7456	11,803						
	7457	11,981						
	1313					5,270,000	$\frac{1}{6.3}$	
	1356				167.6	3,640,000	$\frac{1}{8.6}$	.00000312
	414		1,202					
	467		291					
	272			1,100				
	273			946				
	7458	16,238						
	7459	11,490						
Rutland blue marble from Vermont	1314					6,500,000 7,800,000	$\frac{1}{8.1}$	
	1318					7,500,000	$\frac{1}{7.8}$	
	415		2,069					
	416		2,045					
	274			1,519				
	275			914				
Mountain dark marble from Vermont	7460	12,780						
	7461	12,886						
	1315					9,290,000	$\frac{1}{9.3}$	
	417		2,109					
	451		1,408					.00000433
	276			1,431				
	277			1,475				

Tabulation of results of compression, transverse, and shearing tests, and coefficients of expansion in water—Continued.

Name of stone.	No. of test.	Compressive strength per square inch.	Transverse strength, modulus of rupture per square inch.	Shearing strength per square inch.	Weight per cubic foot.	Compressive modulus of elasticity per square inch.	Ratio of lateral expansion to longitudinal compression.	Coefficient of expansion in water.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		*Inch.*
Sutherland Falls marble from Vermont	7462	16,506						
	7463	15,806						
	1316					12,580,000	$\frac{1}{4}$	
	418		3,054					
	452		1,531					.00000550
	278			2,010				
	279			1,119				
Fossiliferous marble from St. Joe, Searcy County, Ark	7465	10,130						
	7466	10,393						
	7467	10,413						
	1319					8,210,000	$\frac{1}{3}$	
	421		1,615					
	454		567					.00000219
Chocolate marble from St. Joe, Searcy County, Ark	7468	12,494						
	7469	13,762						
	7470	10,577						
	1320					10,740,000	$\frac{1}{3}$	
	422		1,693					
	423		1,534					
Richville white marble from Dekalb, St. Lawrence County, N. Y	7181	13,733						
	7182	10,478						
	7183	12,004						
	7464	13,772						
	1317					12,000,000	$\frac{1}{3}$	
	420		1,144					
	453		533					.00000634
Marble from Marble Hill, Ga	1354				167.7	4,480,000	$\frac{1}{3}$	
	1355				167.8	6,550,000	$\frac{1}{3}$	
	465		604					.00000202
	466		1,471					.00000185
Marble from Tate, Ga.: Creole quarry	1357				169	4,060,000	$\frac{1}{3}$	
	468		828					
Cherokee quarry	1358				168.4	3,980,000	$\frac{1}{3}$	
	469		382					.00000441
Etowah quarry	456		1,789					
Kennesaw quarry	455		1,317					

Limestone, from Isle LaMotte, Vt		7495	13,662				
		7496	15,581				
		1331				14,720,000	$2\frac{1}{2}$
		403		2,483			
		438		786			.00000219
		298			1,946		
		299			2,400		
Limestone, from Wasioja, Dodge County, Minn	Buff color	7481	4,029				
		316			1,084		
	Gray color	7482	5,014				
		448		253			.00000217
		315			1,186		
Limestone, from Junction City, Kans		7700	2,996				
		7701	3,350				
		450		528			.00000300
Limestone, from Fort Riley, Kans		313			1,120		
		314			958		
		471			988		
Limestone from Beaver, Carroll County, Ark		7489	20,281				
		7490	21,397				
		7491	20,064				
		1327				6,530,000	$2\frac{1}{8}$
		1328				6,760,000	$2\frac{1}{4}$
		405		3,023			
		406		2,705			
		404		2,853			
		441		2,247			.00000471
		282			1,641		
		283			2,119		
		284			2,179		
		285			2,053		
Limestone from Mount Vernon, Ky		1343				4,000,000	$2\frac{1}{2}$
		412		1,196			
		413		1,673			
		447		1,076			.00000464
Limestone from Rockwood, Ala		7471	5,752				
		7472	6,162				
		446		690			.00000058
		265			978		
Limestone from Bowling Green, Ky		7473	6,008				
		7474	6,077				
		1321				9,200,000	$2\frac{1}{8}$
		410		1,317			
		445		799			.00000089
		266			1,257		
		267			1,164		

Tabulation of results of compression, transverse, and shearing tests, and coefficients of expansion in water—Continued.

Name of stone.		No. of test.	Compressive strength per square inch.	Transverse strength, modulus of rupture per square inch.	Shearing strength per square inch.	Weight per cubic foot.	Compressive modulus of elasticity per square inch.	Ratio of lateral expansion to longitudinal compression.	Coefficient of expansion in water.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		*Inch.*
Limestone from Bedford, Washington County, Ind.	Buff color	7475	10,446						
		7476	9,129						
		7477	7,462						
		1322					7,160,000	$\frac{1}{4.1}$	
		1323					7,070,000	$\frac{1}{3.8}$	
		408		1,962					
		409		2,155					
		269			1,207				
		270			1,237				
	Blue color	7478	11,636						
		7479	11,247						
		7480	9,586						
		1324					7,250,000	$\frac{1}{3.7}$	
		407		1,867					
		444		958					.00000389
		268			938				
		271			1,096				
Slate from Monson, Me.		1342					12,250,000	$\frac{1}{4.4}$	
Sandstone from Cromwell, Conn.		7483	17,557						
		7484	16,231						
		1326					7,711,000	$\frac{1}{3.4}$	
		396		2,248					
		433		1,500					.00000549
		287			1,601				
		288			1,450				
Sandstone from East Longmeadow, Mass.	Worcester	1341					1,780,000	$\frac{1}{3.9}$	
		1350				135.4	1,910,000	$\frac{1}{7.1}$	.00000517
		397		987					
		461		1,189					
	Kibbe	1340					2,200,000	$\frac{1}{5}$	
		1351				134.	1,100,000	$\frac{1}{2.4}$	.00000577
		398		1,273					
		462		655					
	Maynard	1352				132.7	1,200,000	$\frac{1}{3.3}$	.00000567
		1353				132.9	1,300,000	$\frac{1}{4.7}$	.00000555
		463		660					
		464		884					

Sandstone from Jasper, Ala.	7820	16,570					
	7821	16,620					
	7822	13,700					
	457		1,880				
	470			2,202			
Sandstone from Kettle River, Pine County, Minn.	7487	12,295					
	7488	12,790					
	434		868				.00000696
	280			1,478			
	281			1,632			
Sandstone from Cabin Creek, Johnson County, Ark.	7492	19,746					
	7493	17,921					
	7494	17,738					
	1329				3,900,000	1 1/8	
	402		890				.00000613
	439		2,442				
	295			2,549			
	296			2,291			
	297			2,597			
Sandstone quarried near Fort Smith, Sebastian County, Ark.	7830	11,580					
	7831	13,950					
	1330				3,530,000	1 1/8	
	411		1,761				
	449		1,185				.00000620
	311			2,035			
	312			1,338			
	472			1,921			
Sandstone quarried near Redfield, Bourbon County, Kans.	7485	8,446					
	7486	7,608					
	440		2,088				.00000516
	296			1,940			
Sandstone from Piedmont quarry, near Oakland, Alameda County, Cal.	7613	11,812					
	7614	10,991					
	7615	10,319					
	437		1,063				.00000436
	310			1,626			
Sandstone from Coquille River, Coos County, Oreg.	7414	9,057					
	7415	8,337					
	7416	4,948					
	292			1,248			
Sandstone from Cooper quarry, Douglas County, Oreg.	1337				2,164,000	1 1/4	
	443		724				.00000177
Sandstone from Olympia, Wash.	1338				3,277,000	1/2	
	399		2,073				
	442		2,297				.00000320
	293			1,563			
	294			1,722			
Sandstone from Chuckanut, Wash.	1339				2,120,000	1 1/4	
	400		2,016				
	436		961				.00000394
	291			1,809			

Tabulation of results of compression, transverse, and shearing tests, and coefficients of expansion in water—Continued.

Name of stone.	No. of test.	Compressive strength per square inch.	Transverse strength, modulus of rupture per square inch.	Shearing strength per square inch.	Weight per cubic foot.	Compressive modulus of elasticity per square inch.	Ratio of lateral expansion to longitudinal compression.	Coefficient of expansion in water.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		*Inch.*
Sandstone from Tenino, Wash.	7418	6,691						
	7419	6,567						
	7420	6,806						
	1325					1,020,000	$\frac{1}{19}$	
	401		667					
	435		823					.00000347
	289			1,063				
	290			1,389				
Sandstone from Pittsburg, Wash	7823	19,208						
Dyckerhoff's neat cement	1359					2,620,000	$\frac{1}{17}$	
	1360					2,200,000	$\frac{1}{13}$	
Plaster of paris	1361	795						
	1362					920,000	$\frac{1}{18}$	

BRICKS, TILES, AND BUILDING BLOCKS.

ABSORPTION OF WATER AND COMPRESSION TESTS.

BRICKS.

ABSORPTION OF WATER.

Compression test number.	Contributor.	Weight, dry.		Absorption of water.			
				Total.		By weight.	By volume.
		Lbs.	*Ounces.*	*Lbs.*	*Ounces.*	*Per ct.*	*Per ct.*
7317	Somerset and Johnsonburg Manufacturing Co	6	6½	.....	2⅞	2.68	5.95
7318	....do	6	3½	.....	2⅞	2.76	6.08
7319	....do	7	7	.....	2⅝	2.31	4.93
7320	....do	6	8	.....	¼	0.72	1.63
7321	....do	6	13	.....	¼	0.69	1.54
7507	Gladding, McBean & Co	5	12¼	.....	10¼	11.1	21.9
7510	....do	5	8½	.....	10	11.3	21.6
7512	....do	5	8½	.....	11⅛	13.3	24.0
7516	....do	5	11½	.....	5½	5.8	11.9
7519	....do	6	11⅝	.....	11½	10.4	19.5
7520	Bay State Brick Co	4	9½	.....	2½	3.4	7.7
7522	....do	4	8½	.....	2⅜	3.1	7.1
7527	Brush & Schmidt	5	12½	.....	3½	3.5	8
7528	....do	5	8¾	.....	4	4.5	10
7529	....do	5	9	.....	¼	0.28	0.67
7531	National Brick and Tile Co	6	6¾	.....	5½	5.6	12.7
7533	....do	5	7¼	.....	9	10.3	20.6
7536	Kansas City Hydraulic Press Brick Co	5	6	.....	11½	13.1	24.9
7539	....do	5	5½	.....	10⅛	12.0	22.7
7541	Clark Pressed Brick Co	5	6½	.....	8	9.3	16.8
7546	....do	5	6½	.....	3¾	4.3	8.4
9547	....do	5	2½	.....	5	6.1	11.5
7549	....do	5	3	.....	2½	3.1	6.3
7550	....do	5	1½	.....	2¼	2.8	5.8
	Superior Brick Co., No. 1	3	11⅝	.....	12	20.1	32.7
	Superior Brick Co., No. 2	3	11	.....	15½	26.7	39.6
	Superior Brick Co., No. 3	3	11½	.....	17½	29.1	42.2
7551	The A. O. Jones Brick and Tile Co	6	9½	.....	1½	1.2	2.5
7552	....do	6	6½	.....	1¾	1.7	3.7
7553	....do	6	6	.....	1½	1.2	2.7
7554	....do	8	11½	.....	1½	0.9	2.0
7555	....do	8	14½	.....	¾	0.52	1.2
7556	....do	8	12⅜	.....	1½	1.2	2.7
7559	The Coaldale Brick and Tile Co	5	12⅛	.....	10⅛	11.3	21.1
7562	....do	5	7	.....	11	12.6	22.0
7563	....do	7	1½	.....	½	0.44	0.98
7564	....do	7	2½	.....	¼	0.22	0.49
7565	....do	6	8	.....	1½	1.2	2.6
7566	....do	6	7½	.....	¼	0.24	0.54
7567	....do	6	5½	.....	4½	4.2	9.2
7568	....do	6	15½	.....	3½	2.9	6.6
7578	Nosh Hamlet	5	6½	1	1	19.6	32.7
7580	....do	5	5½	.....	14	16.4	29.0
7581	....do	5	5½	.....	12½	14.9	26.0
7583	....do	4	15½	.....	¾	0.9	1.9
7586	....do	5	1	.....	2	2.5	5.1
7588	....do	5	8½	.....	15	16.9	28.4
7589	The Capital City Vitrified Brick and Paving Co	5	9½	.....	1½	1.9	4.3
7590	....do	5	9	.....	2⅛	2.8	6.1
7591	....do	5	8½	.....	1⅛	1.7	3.8
7592	Monticello Brick Co	5	5½	.....	2	2.3	5.4
7593	....do	5	10½	.....	1½	1.9	4.6
7596	....do	5	10½	.....	3	3.3	7.7
7597	....do	5	7½	.....	10½	12.0	23.4
7598	A. Humphrey	6	3½	.....	¼	0.25	0.58
7599	....do	6	3½	.....	¼	0.25	0.58
7600	....do	6	11½	.....	¼	0.23	0.54

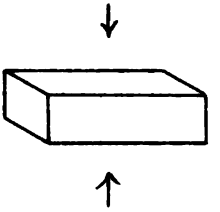
ABSORPTION OF WATER—Continued.

Compression test number.	Contributor.	Weight, dry.		Absorption of water.			
				Total.		By weight.	By volume.
		Lbs.	*Ounces.*	*Lbs.*	*Ounces.*	*Per ct.*	*Per ct.*
7603	Blanford Brick and Tile Co	5	7½	.....	3¼	3.7	7.6
7604	.....do	5	1½	.....	3½	4.3	9.2
7605	.....do	7	10¾	.....	13⅛	11.0	20.3
7606	Sayre and Fisher Co	5	4½	.....	8½	12.8	19.3
7607	.....do	5	⅛	.....	10¼	13.0	24.4
7608	.....do	5	5½	.....	6	6.9	12.9
7609	.....do	5	1½	.....	8½	10.4	18.8
7610	M. D. Hunton	5	12½	.....	2½	2.7	6.2
7611	.....do	5	6	.....	1½	1.7	4.1
7612	.....do	5	6½	.....	6	6.9	15.1
7622	Powhatan Clay Manufacturing Co	5	¼	.....	8¾	10.9	20.7
7623	.....do	5	½	.....	9½	11.8	22.0
7624	.....do	4	9½	.....	4⅜	6.1	13.6
7625	.....do	4	11½	.....	4½	6.0	13.1
7626	.....do	4	9½	.....	4⅜	6.1	13.3
7627	.....do	4	7½	.....	8¾	12.2	24.3
7628	.....do	4	7½	.....	6	8.4	17.8
7629	.....do	4	6½	.....	6½	8.8	18.6
7633	John Eharker	6	13½	.....	13½	12.5	21.1
7636	.....do	6	4½	.....	13½	13.1	21.3
7639	Gay Head Clay and Brick Co	5	7½	.....	5½	6.3	12.3
7642	.....do	5	9	.....	6½	7.0	13.6
7702	.....do	6	10½	.....	15½	14.3	25.0
7704	.....do	7	2½	1	½	14.2	24.6
7706	New Hampshire Moulded Granite Co	6	4½	.....	4	4.	8.1
7709	New England Steam Brick Co	5	10½	.....	11¾	13.0	24.0
7649	.....do	5	7	.....	10¾	12.4	23.5
7652	.....do	5	10	.....	5¾	6.4	13.3
7655	.....do	5	13	.....	8½	9.1	17.9
7658	.....do	6	½	.....	4½	4.4	9.4
7661	.....do	5	13	.....	2½	2.4	5.6
7662	.....do	5	8	.....	11½	12.8	24.6
7663	.....do	4	13	.....	14¾	19.1	32.2
7667	.....do	5	9	.....	13½	15.2	27.3
7677	.....do	5	12½	.....	11¾	12.7	23.7
7680	.....do	5	3½	.....	6½	7.8	15.4
7671	.....do	5	8½	.....	1¾	1.7	3.9
7674	.....do	5	9½	.....	1	1.1	2.6
a 338	.....do	5	1¾	.....	12	14.7	25.8
7685	Pacific Clay Manufacturing Co	5	6½	.....	12½	14.3	26.2
7686	.....do	5	10½	.....	13½	14.9	27.6
7688	Grant Brick Co	6	15½	.....	1½	1.1	2.5
7689	.....do	7	2½	.....	1⅜	1.5	3.6
7690	.....do	6	15½	.....	1⅜	1.6	3.6
7693	Muscatine Terra Cotta Lumber Co	5	4½	.....	1½	1.5	3.2
7694	.....do	5	7¾	.....	1½	1.4	3.1
7695	.....do	5	7	.....	1½	1.4	3.1
		Grammes.		*Grammes.*			
7711	American Encaustic Tiling Co	144.1		8.5		5.9	12.8
7712	.....do	141.1		4.0		2.8	6.4
7713	.....do	147.9		4.6		3.1	7.0
7714	.....do	151.3		3.2		2.1	4.9
7715	.....do	163.6		5.2		3.2	7.4
7716	.....do	153.4		3.3		2.1	5.0
7717	.....do	134.7		13.3		9.9	19.9
7718	.....do	167.0		0.1		0.06	0.14
7719	.....do	166.8		0.		0.	0.
7720	.....do	168.0		0.1		0.06	0.14
7721	.....do	173.5		0.		0.	0.
7722	.....do	171.3		0.2		0.12	0.27
7723	.....do	170.0		0.4		0.23	0.56
7724	.....do	164.7		0.2		0.12	0.29
7725	.....do	798.5		0.3		0.04	0.09
7726	.....do	792.6		0.4		0.05	0.12
7727	.....do	814.2		0.5		0.06	0.14
7728	.....do	194.1		27.7		14.2	26.8
7729	.....do	202.4		25.0		12.3	23.9

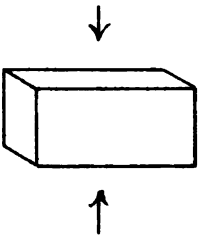
a Transverse test.

Tests of Bricks.

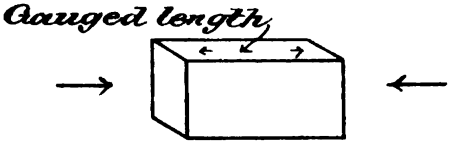
Compression tests.



Flatwise.



Edgewise



Compressive Elastic Properties.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

BRICKS FROM THE BAY STATE BRICK COMPANY, BOSTON, MASS.

Made on special brick machines from clay procured in vicinity of Boston.

Hard-burnt red brick, used for building, paving, sewers, etc.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7520	3.38	2.14	7.71	16.50	37,000	246,100	14,915	Tested on edge.
7521	2.14	3.36	7.85	26.38	38,000	453,200	17,180	
7522	3.38	2.12	7.64	16.20	26,000	279,500	17,253	Do.
7523	2.14	3.36	7.71	25.91	47,000	381,600	14,728	

Compression test of half brick after tests by transverse loads.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7761	346	2.20	3.40	4.04	13.74	21,000	154,000	11,274	

PAVING BRICKS FROM SOMERSET AND JOHNSONBURG MANUFACTURING COMPANY, BOSTON, MASS.

[Factories at Somerset, Mass., and Johnsonburg, Pa.]

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7317	.....	3.92	2.41	8.45	20.36	67,000	151,900	7,412	Tested on edge.
7318	.....	2.34	3.99	8.37	33.40	68,000	458,200	13,719	Do.
7319	.....	4.23	2.58	8.83	22.78	39,000	274,100	12,032	Do.
7320	.....	4.01	2.37	8.36	19.81	48,000	252,100	12,726	Do.
7321	5	4.02	2.48	8.39	20.81	42,000	264,600	12,715	Do.

BRICKS FROM THE GAY HEAD CLAY AND BRICK COMPANY, CHELSEA, MASS.

BUFF-COLORED BRICKS.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7637	2.32	4.14	8.20	33.95	108,000	217,200	6,398	
7638	2.38	4.15	8.27	34.32	105,000	206,500	6,017	
7639	2.30	4.10	8.16	33.46	68,000	216,000	6,455	
7640	4.10	2.25	8.13	18.29	108,000	131,700	7,201	Tested on edge.
7641	4.15	2.30	8.26	19.00	53,000	133,600	7,032	Do.
7642	4.17	2.30	8.27	19.02	109,000	135,800	7,140	Do.

DARK BUFF SPECKLED BRICKS.

7643	1.57	4.06	11.96	48.56	188,000	499,200	10,280	
7644	1.58	4.05	11.81	47.83	285,000	529,600	11,072	
7645	4.20	1.54	12.04	18.54	54,000	98,600	5,318	Tested on edge.
7646	4.08	1.54	11.97	18.43	89,000	105,400	5,711	Do.

FIRE BRICKS, BRANDED "SALAMANDER XX."

7647	2.52	4.70	9.40	44.18	74,000	124,800	2,824	
7702	2.48	4.60	9.25	42.55	71,000	119,100	2,799	
7703	4.58	2.42	9.20	22.26	49,000	49,100	2,206	Tested on edge.
7704	4.69	2.58	9.44	24.35	55,000	56,300	2,312	Do.

Compression tests of half bricks after test by transverse loads.

BUFF COLORED.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7732	317	2.39	4.08	4.72	19.26	79,000	111,200	5,774	
7786	317	2.39	4.08	2.96	12.08	36,000	59,200	4,900	Tested wet.
7733	318	2.32	4.04	4.28	17.29	72,000	96,300	5,570	
7787	318	2.32	4.04	3.61	14.58	21,000	77,950	5,346	Do.
7734	319	4.12	2.30	4.35	10.00	74,200	74,200	7,420	Tested on edge.
7735	320	4.14	2.30	4.30	9.89	56,000	66,300	6,704	Do.

BUFF SPECKLED.

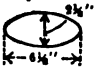
7738	323	1.57	4.02	6.34	25.49	143,000	276,500	10,847	
7739	324	1.55	4.03	5.45	21.96	117,000	208,400	9,490	
7740	325	4.01	1.52	6.16	9.36	58,500	69,500	7,425	Tested on edge.
7741	326	4.10	1.58	5.92	9.35	60,600	60,600	6,481	Do.
7790	326	4.10	1.58	3.99	6.30	31,900	31,900	5,063	Tested wet on edge.

FIRE BRICKS.

7736	321	2.51	4.73	4.80	22.70	59,000	59,900	2,639	
7788	321	2.51	4.73	4.30	20.34	39,000	47,200	2,321	Tested wet.
7737	322	2.53	4.72	4.67	22.04	42,000	51,700	2,346	
7789	322	2.53	4.72	4.12	19.45	29,500	41,200	2,118	Do.

BRICKS FROM BLANDFORD BRICK AND TILE COMPANY, RUSSELL, MASS.

BUILDING BRICKS.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7601	No. 27	2.18	3.93	8.15	32.52	161,000	239,900	7,377	Buff color.
7602	K	2.18	3.96	8.13	32.19	128,000	306,050	9,507	Gray color.
7603	K	2.28	4.02	8.19	32.92	120,000	199,800	6,069	Dark color. Has sunken panels ".10 deep. 

DARK BROWN PAVING BRICK.

7604	A	3.93	2.21	8.17	17.41	51,000	114,200	6,559	Tested on edge.

BUFF FIRE BRICK.

7605	.....	2.57	4.78	9.47	45.27	76,000	108,300	2,392	

Compression tests of half brick after test by transverse loads.

BUILDING BRICK, BUFF COLOR.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7765	350	2.21	4.00	4.55	18.20	102,000	103,500	5,687	

BRICKS FROM THE NEW ENGLAND STEAM BRICK COMPANY, PROVIDENCE, R. I.

[Works at Barrington and Nayatt, R. I.]

LIGHT-RED BRICK, NO. 0.

No. of test.	Dimensions: Height.	Dimensions: Compressed surface.		Sectional area.	First crack.	Ultimate strength: Total.	Ultimate strength: Per square inch.	Remarks.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7707	2.45	4.06	8.18	33.21	112,000	202,100	6,085	
7708	2.41	4.08	8.24	33.62	158,000	253,700	7,546	
7709	2.47	4.13	8.28	34.20	77,000	207,300	6,061	

RED SMOOTH-CUT BRICK, NO. 1.

7710	2.43	4.02	8.21	33.00	217,400	217,400	6,588	
7648	2.40	3.98	8.12	32.32	126,500	223,200	6,906	
7649	2.39	4.03	8.19	33.01	71,000	190,900	5,783	

RED SMOOTH-CUT BRICK, NO. 2.

7650	2.38	3.93	8.02	31.52	215,000	333,800	10,590	
7651	2.38	4.02	8.13	32.68	221,000	285,300	8,730	
7652	2.38	3.92	7.98	31.28	114,000	317,100	10,137	

RED SMOOTH-CUT BRICK, NO. 3.

7653	2.28	3.90	8.05	31.39	97,000	391,000	12,456	
7654	2.40	4.04	8.22	33.21	175,000	268,100	8,073	
7655	2.43	4.07	8.28	33.70	201,000	277,200	8,225	

RED SMOOTH-CUT BRICK, NO. 4.

7656	2.42	4.02	8.12	32.64	178,000	361,500	11,075	
7657	2.38	3.80	7.86	29.87	121,000	267,000	8,939	
7658	2.44	3.99	7.98	31.84	137,000	355,100	11,153	

RED SMOOTH-CUT BRICK, NO. 5.

7659	2.35	3.51	8.04	28.22	106,000	340,600	12,069	
7660	2.35	3.82	7.78	29.72	128,000	293,000	9,859	
7661	2.35	3.77	7.88	29.71	151,000	272,500	9,172	

DARK BUFF FRONT BRICK, NO. 51.

7662	2.36	4.18	8.16	34.11	57,000	146,500	4,294	

SMOOTH-CUT BUFF BRICK, NO. 51.

7663	2.36	4.18	8.14	34.03	176,000	199,300	5,857	
7664	2.39	4.13	8.16	33.70	93,000	150,400	4,463	

LIGHT CHOCOLATE-COLORED BRICK.

7665	2.41	4.14	8.30	34.36	191,000	227,900	6,633	
7666	2.41	4.14	8.32	34.44	134,000	181,500	5,270	

BRICKS FROM THE NEW ENGLAND STEAM BRICK COMPANY, PROVIDENCE, R. I.—Continued.

"63 PRESS" LIGHT CHOCOLATE-COLORED BRICK.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7667	2.44	4.19	8.35	34.99	148,000	171,000	4,887	

"64" DARK CHOCOLATE-COLORED BRICK.

7668	2.40	4.16	8.32	34.61	205,000	244,400	7,061	

"LIGHT HARD WATER-STRUCK BRICK FROM YARD NO. 1."

7675	2.31	4.14	8.24	34.11	186,000	229,500	6,728	
7676	2.33	4.20	8.45	35.49	134,000	181,600	5,116	
7677	2.43	4.17	8.43	35.15	113,000	186,700	5,311	

"HARD BODY BRICK FROM YARD NO. 2."

7678	2.38	3.70	8.14	30.12	228,000	340,700	11,311	
7679	2.40	3.70	8.08	29.90	47,000	329,900	11,033	
7680	2.41	3.73	8.10	30.21	139,000	336,200	11,129	

LIGHT HARD SAND-STRUCK BRICK FROM YARD NO. 2, USED FOR FILLING OR INSIDE PURPOSES.

7285	2.50	3.76	8.18	30.92	144,000	281,800	9,113	
7286	2.52	3.77	8.19	30.88	162,000	258,100	8,358	
7287	2.52	3.90	8.44	32.92	126,000	189,700	5,762	

LIGHT-BUFF FRONT BRICK NO. 55.

7681	2.38	4.06	8.05	32.68	66,000	105,700	3,234	
7682	2.38	4.01	7.95	31.88	74,000	114,100	3,579	
7683	2.41	4.08	8.05	32.84	58,000	102,000	3,106	

SMOOTH-CUT PAVING BRICK.

7669	2.35	3.68	7.60	27.97	72,000	283,400	10,132	
7670	2.28	3.70	7.50	27.75	48,000	218,200	7,863	
7671	3.65	2.34	7.70	18.02	27,000	232,100	12,880	Tested on edge.

PAVING BRICK.

7672	2.22	3.80	7.71	29.30	39,000	384,800	13,133	
7673	2.27	3.81	7.86	29.95	137,000	454,000	15,158	
7674	3.82	2.24	7.74	17.34	112,000	189,900	10,951	Tested on edge.

Compression tests of half bricks after test by transverse loads.

LIGHT-RED BRICK NO. 0.

No. of test.	Transverse test number.	Dimensions. Height.	Compressed surface.		Sectional area.	First crack.	Ultimate strength. Total.	Per square inch.	Remarks.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7742	327	2.48	4.11	4.24	17.43	51,000	102,400	5,874	
7791	327	2.48	4.11	3.50	14.38	34,000	73,400	4,506	Tested wet.

RED SMOOTH-CUT BRICK NO. 1.

7743	328	2.41	4.02	4.00	16.08	30,800	92,900	5,777	
7792	328	2.41	4.02	3.65	14.67	23,000	66,100	4,506	Tested wet.

RED SMOOTH-CUT BRICK NO. 2.

7744	329	2.45	3.97	4.20	16.67	87,000	131,500	7,888	
7793	329	2.45	3.97	3.63	14.41	59,000	128,500	8,917	Tested wet.

RED SMOOTH-CUT BRICK NO. 3.

7745	330	2.34	3.93	3.14	12.34	55,000	131,100	10,624	
7794	330	2.34	3.93	4.17	16.39	28,800	171,800	10,482	Tested wet.

RED SMOOTH-CUT BRICK NO. 4.

7746	331	2.37	3.99	4.48	17.88	99,000	203,000	11,353	
7795	331	2.37	3.99	3.12	12.45	48,000	106,700	8,088	Tested wet.

RED SMOOTH-CUT BRICK NO. 5.

7747	332	2.34	3.82	3.74	14.29	77,000	138,200	9,671	
7796	332	2.34	3.82	4.02	15.36	32,000	148,600	7,674	Tested wet.
7748	333	2.37	3.85	3.82	14.71	43,900	125,900	8,559	
7797	333	2.37	3.85	3.58	13.78	42,500	110,050	7,986	Tested wet.

DARK-BUFF FRONT BRICK NO. 51.

7749	334	2.34	4.20	4.40	18.48	79,900	108,200	5,855	
7798	334	2.34	4.20	3.02	12.68	29,000	57,100	4,503	Tested wet.

"03 PRESS" LIGHT CHOCOLATE COLOR.

7751	336	2.41	4.17	4.40	18.35	67,000	81,600	4,447	
7800	336	2.41	4.17	3.37	14.05	30,800	44,700	3,181	Tested wet.

LIGHT HARD WATER-STRUCK, FROM YARD NO. 1.

7752	337	2.47	4.06	3.90	15.38	57,000	86,150	5,601	
7801	337	2.47	4.06	3.98	16.16	37,500	73,200	4,530	Tested wet.

Compression tests of half bricks after test by transverse loads—Continued.

HARD BODY BRICK, FROM YARD NO. 2.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7754	339	2.42	3.68	3.70	13.62	52,000	131,500	9,655	
7802	339	2.42	3.68	3.90	14.35	38,000	89,400	6,230	Tested wet.

LIGHT HARD SAND-STRUCK BRICK, FROM YARD NO. 2.

7753	338	2.52	3.84	3.88	14.90	66,000	95,900	6,436	

LIGHT-BUFF FRONT BRICK NO. 55.

7750	335	2.37	4.01	3.97	15.92	48,600	37,300	3,599	
7799	335	2.37	4.01	3.76	15.08	31,000	49,600	3,289	Tested wet.

SMOOTH-CUT PAVING BRICK.

7755	340	2.35	3.68	3.10	11.41	41,000	94,600	8,291	

PAVING BRICK.

7756	341	2.36	3.75	3.82	14.32	49,500	146,200	10,209	
7757	342	2.39	3.72	3.51	13.06	30,000	139,900	10,712	
7803	342	2.39	3.72	3.86	14.36	29,000	142,200	9,902	Tested wet.

Bricks from Brush & Schmidt, Pressed Brick Manufacturers, Buffalo, N. Y.

[Works at Jewettville, N. Y.]

Pressed brick made from shale (Hamilton group) with "Boyd" dry press, for use in fine fronts of buildings. Color, red.

No. 1. Light color, least burnt.

No. 2. Darker shade, medium hard burnt.

No. 3. Dark shade, hard, not vitrified.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7524	No. 1	2.31	3.91	7.96	31.12	278,000	425,800	13,682	
7525	No. 2	2.30	3.88	7.93	30.77	412,000	514,300	16,714	
7526	No. 3	2.30	3.88	7.92	30.73	480,000	574,000	18,679	

Paving brick, stiff mud brick, made on Tiffany Centennial machine from shale (Hamilton group).

No. 7527. Light color.

No. 7528. Medium hard.

No. 7529. Dark, repressed, and vitrified.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7527	.....	4.07	2.22	7.75	17.20	19,000	173,800	10,104	Tested on edge.
7528	.....	4.06	2.21	7.71	17.04	46,000	172,900	10,147	Do.
7529	.....	3.77	2.22	7.59	16.85	32,000	321,600	19,086	Do.

Bricks from Sayre & Fisher Company, Sayreville, N. J.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7606	No. 8	2.25	3.98	8.26	32.87	157,000	289,900	8,820	Salmon color.
7607	No. 9	2.20	4.06	8.31	33.74	166,000	333,700	9,890	Cream color.
7608	No. 13	2.23	4.22	8.53	36.00	284,000	518,100	14,391	Buff speckled.
7609	No. 14	2.21	4.18	8.44	35.28	88,000	329,500	9,339	Do.

Bricks from the National Brick and Tile Company, Bradford, Pa.

[Works at Lewis Run, Pa.]

No. 1. Red face brick, hard burnt.

No. 2. Red face brick, soft burnt.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7530	No. 1	2.33	4.03	7.98	32.16	670,000	800,000	24,875	Not fractured.
7531	No. 1	4.07	2.38	8.06	19.18	198,060	220,800	11,512	Tested on edge.
7532	No. 2	2.32	4.00	8.02	32.08	196,000	225,160	7,017	
7533	No. 2	2.35	4.01	8.01	32.12	197,000	237,500	7,394	

PAVING BRICKS FROM GRANT BRICK COMPANY, FRANKLIN, PA.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7688	4.12	2.42	8.40	20.33	142,000	380,100	18,697	Tested on edge.
7689	4.00	2.45	8.65	21.19	108,000	390,000	18,433	Do.
7690	4.09	2.40	8.49	20.38	84,000	373,000	18,302	Do.
7691	2.40	4.14	4.41	18.26	116,000	286,400	15,684	Half bricks from the same brick.
7692	2.40	4.13	4.02	16.60	96,000	262,500	15,813	

Compression tests of half bricks after test by transverse loads. Transverse test No. 366.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7781	2.41	4.09	4.12	16.85	94,000	275,500	16,350	
7819	2.41	4.09	3.78	15.46	24,000	273,000	17,658	

BRICKS FROM THE WASHINGTON HYDRAULIC-PRESS BRICK COMPANY, WASHINGTON, D. C.

Bricks made by the semi-dry clay process and pressed into moulds by hydraulic machinery.

Color of bricks, dark red; hard burnt.

Common red brick, burned in common kilns, and known as ordinary building brick; generally used for outside walls, sides and back.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7444	2.33	4.14	8.30	34.36	301,000	362,100	10,538	
7445	2.21	4.09	8.34	34.11	252,000	259,900	7,619	
7446	2.30	4.11	8.25	33.91	277,000	402,500	11,870	

No. 10 press brick, burned in patent down-draft kiln; used for face work on the outside of buildings or facing inside work of any kind.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7447	2.30	4.07	8.28	33.70	285,000	369,600	10,967	
7448	2.30	4.07	8.30	33.78	314,000	380,900	11,276	
7449	2.30	4.10	8.32	34.11	366,000	371,200	10,882	

Arch brick, burned in common kilns, the arches being built of green brick; used for foundations.

No. of test.	Dimensions.			Sectional area	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7450	2.22	3.81	8.51	32.42	303,000	361,500	11,150	
7451	2.22	3.96	8.29	32.83	228,000	369,600	11,258	
7452	2.28	3.79	8.49	32.18	230,000	311,600	9,683	

Bricks from the Powhatan Clay Manufacturing Company, Richmond, Va.

CREAM-WHITE BRICK.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7622	No. 1	2.24	3.87	8.06	31.19	148,000	197,600	6,335	
7623	No. 1	2.37	3.89	8.08	31.43	121,000	153,500	4,884	

DARK RED BRICK.

7624	No. 2	2.14	3.52	7.60	26.75	88,000	376,100	14,060	
7625	No. 2	2.13	3.59	7.74	27.79	62,000	343,600	12,364	
7626	No. 2	2.12	3.58	7.67	27.46	72,000	249,900	9,100	

LIGHT RED BRICK.

7627	No. 3	2.21	3.66	7.65	28.00	98,000	315,400	11,264	
7628	No. 3	2.16	3.58	7.53	26.96	47,000	460,800	17,092	
7629	No. 3	2.15	3.58	7.54	26.99	46,000	403,100	14,935	

KIBBE SANDSTONE FROM EAST LONGMEADOW, MASS.

Coefficient of expansion previously determined in water baths.

No. 1351.

ength, 23″.98.
ectional area, 4″.02 × 6″.02=24.20 square inches.
eight, 45 pounds=134 pounds per cubic foot.
auged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,420	100	0.	0.	Initial load.
12,100	500	.0160	.....	
24,200	1,000	.0255	.....	
36,300	1,500	.0325	.0102	
48,400	2,000	.0389	.....	
36,300	1,500	.0347	.....	
24,200	1,000	.0295	.....	E = 1,100,000 pounds per square inch.
12,100	500	.0224	.....	
2,420	100	.....	.0116	
12,100	500	.0200	.....	
24,200	1,000	.0277	.....	
36,300	1,500	.0337	.....	
48,400	2,000	.0390	.....	
36,300	1,500	.0347	.....	
24,200	1,000	.0296	.....	
12,100	500	.0225	.....	
2,420	100	.....	.0119	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,420	100	0.	0.	Initial load.
48,400	2,000	.0018	.....	
2,420	100	.....	.0001	
48,400	2,000	.0018	.....	
2,420	100	.....	.0002	
48,400	2,000	.0018	.....	
2,420	100	.....	.0001	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{4.4}$.
This specimen used in transverse test No. 462.

BRICKS FROM THE COALDALE BRICK AND TILE COMPANY, COALDALE, JEFFERSON COUNTY, ALA.

BUFF-COLORED PRESS BRICK.

No. of test.	Dimensions.		Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.			Total.	Per square inch.	
	Inches.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7557	2.38	4.18	8.48	35.45	278,000	426,500	12,031
7558	2.34	4.20	8.47	35.57	308,000	527,100	14,818
7559	2.40	4.20	8.51	35.74	348,000	453,900	12,700

RED-COLORED PRESS BRICK.

7560	2.39	4.00	8.32	33.28	97,900	125,300	3,765	
7561	2.42	3.96	8.30	32.87	93,000	93,100	2,832	
7562	2.30	4.55	8.25	37.54	139,000	147,600	3,932	

PAVING BRICKS.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7563	A	3.54	2.90	8.51	24.68	47,000	261,200	10,583	Tested on edge.
7564	A	3.53	2.94	8.53	25.08	28,000	212,800	8,485	Do.
7565	B	3.45	2.89	8.32	24.04	37,000	149,200	6,206	Do.
7566	B	3.45	2.83	8.22	23.26	39,000	178,100	7,657	Do.
7567	C	3.43	2.85	8.19	23.34	51,000	201,100	8,616	Do.
7568	C	3.45	2.90	8.54	24.77	63,000	200,500	9,034	Do.

Compression tests of half bricks after test by transverse loads.

VITRIFIED PAVING BRICK, A.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7778	360	3.63	2.92	3.70	10.80	21,000	171,100	15,842	Tested on edge.
7815	360	3.63	2.92	4.25	12.41	27,000	139,900	11,273	Tested wet on edge.

VITRIFIED PAVING BRICK, C.

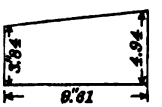
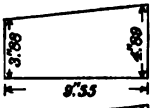
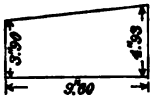
7779	361	3.61	2.89	4.03	11.65	63,000	81,500	6,996	Tested on edge.

FIRE BRICKS FROM JOHN EHARKER, ASHBY, ALA.

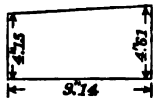
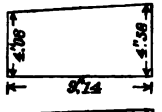
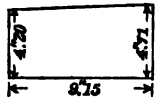
ARCH BRICK FOR COKE OVENS.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7630	No. 2	5.35	4.43	9.13	40.45	99,000	104,800	2,591	2 bricks tested together.

BULLHEAD BRICKS FOR LIMEKILNS, ETC.

7631	No. 3	2.55		42.19	117,000	140,500	3,330
7632	No. 3	2.50		41.88	86,000	114,900	2,744
7633	No. 3	2.65		42.38	83,000	129,800	3,063

RIM BRICKS FOR COKE OVENS.

7634	No. 4	2.60		40.03	124,000	148,400	3,707
7635	No. 4	2.60		39.58	91,000	152,100	3,843
7636	No. 4	2.63		40.76	123,000	151,100	3,707

Compression tests of half bricks after test by transverse loads.

FIRE BRICK NO. 1.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7758	343	2.54	4.26	4.58	19.51	42,000	47,100	2,414	
7804	343	2.54	4.26	3.91	16.66	28,000	31,400	1,885	Tested wet.

Paving Bricks and Blocks from the A. O. Jones Brick and Terra Cotta Company, Zanesville, Ohio.

All made from stiff mud by an auger machine, side cut. The blocks are repressed.

The bricks and blocks are dried by steam heat and burnt with coal in down-draft kilns.

VITRIFIED PAVING BRICKS.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7551	3.93	2.68	7.97	21.36	64,000	185,200	8,670	Tested on edge.
7552	3.91	2.60	8.01	20.83	48,000	161,100	7,734	Do.
7553	3.88	2.60	7.94	20.64	52,000	171,500	8,309	Do.

VITRIFIED PAVING BLOCKS. BRANDED "JONES PAT. Z. O."

7554	3.95	3.05	9.07	27.66	63,000	257,300	9,302	
7555	3.99	3.03	9.10	27.57	95,000	188,600	6,841	
7556	3.98	3.03	9.16	27.75	66,000	203,100	7,319	

Compression tests of half bricks after test by transverse loads.

VITRIFIED PAVING BRICK.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7763	348	3.93	2.57	4.15	10.67	28,000	96,400	9,035	Tested on edge.

VITRIFIED PAVING BLOCK.

7764	349	4.02	3.05	4.39	13.39	73,000	159,900	11,942	Tested on edge.
7807	349	4.02	3.05	4.70	14.33	63,900	113,800	7,941	Tested wet on edge.

Building Brick from the Superior Brick Company, Rockford, Ill.

HARD BURNT.

No. of test.	Marks.	Dimensions. Height.	Dimensions. Compressed surface		Sectional area.	First crack.	Ultimate strength. Total.	Ultimate strength. Per square inch.	Remarks.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7569	No. 1	2.14	3.44	7.81	26.87	134,000	181,200	6,743	
7570	No. 1	2.15	3.49	7.95	27.75	164,800	164,800	5,939	
7571	No. 1	2.18	3.50	7.97	27.89	163,000	168,200	6,031	

MEDIUM HARD BURNT.

7572	No. 2	2.21	3.65	8.17	29.82	92,350	92,350	3,097	
7573	No. 2	2.28	3.63	8.22	29.84	53,800	53,800	1,803	
7574	No. 2	2.27	3.65	8.17	29.82	50,500	50,500	1,693	

SOFT BURNT.

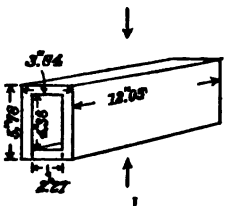
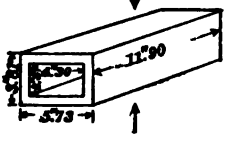
7575	No. 3	2.28	3.70	8.29	30.67	29,400	29,400	958	
7576	No. 3	2.28	3.70	8.25	30.52	34,900	34,900	1,143	
7577	No. 3	2.30	3.72	8.30	30.88	29,850	29,850	966	

Paving Bricks and Hollow Building Blocks from Muscatine Terra Cotta Lumber Company, Muscatine, Iowa.

PAVING BRICKS.

No. of test.	Dimensions. Height.	Dimensions. Compressed surface.		Sectional area.	First crack.	Ultimate strength. Total.	Ultimate strength. Per square inch.	Remarks.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7693	3.66	2.34	7.80	18.25	98,000	181,800	9,962	Tested on edge.
7694	3.82	2.34	7.73	18.09	102,000	216,100	11,946	Do.
7695	3.76	2.34	7.73	18.09	56,000	160,900	8,894	Do.
7696	2.38	3.65	7.78	28.40	49,000	325,200	11,451	
7697	2.40	3.63	7.88	28.60	32,000	284,800	9,958	

HOLLOW BUILDING BLOCKS.

7698		*Gross.* 46.27	.....	.....	2,038	
		Net. 18.92	55,000	94,300	4,964	
7699		*Gross.* 68.19	.....	.....	1,198	
		Net. 17.02	18,000	81,700	4,800	

Bricks from the Kansas City Hydraulic-Press Brick Company, Kansas City, Mo.

Building brick made from clay procured 8 miles northeast from Wyandotte, Wyandotte County, Kans., and burned in Wingard patent up-draft calorific kilns. Color, red.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7534	No. 1	2.33	4.05	8.51	34.47	305,000	386,800	11,221	
7535	No. 1	2.32	4.01	8.36	33.52	310,000	424,600	12,667	
7536	No. 1	2.35	4.02	8.27	33.25	327,000	395,500	11,895	

Building brick made from clay procured from a field situated in eastern part of Kansas City, Jackson County, Mo., and burned in Graves patent duplex down-draft kilns. Color, red.

Both Nos. 1 and 2 were manufactured by the dry clay process and pressed by the Ethan Rogers patent hydraulic brick press.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7537	No. 2	2.31	4.10	8.31	34.07	328,000	466,800	13,701	
7538	No. 2	2.26	4.10	8.30	34.03	320,000	495,500	14,561	
7539	No. 2	2.31	4.08	8.28	33.78	210,000	388,100	11,489	

Compression tests of half bricks after test by transverse loads.

RED BRICK NO. 1.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7759	344	2.33	3.98	4.44	13.69	191,000	247,400	18,072	
7805	344	2.33	3.96	3.38	13.45	111,000	160,200	11,911	Tested wet.

RED BRICK NO. 2.

7760	345	2.32	4.14	4.24	17.55	174,000	210,600	12,000	
7806	345	2.32	4.14	4.09	16.93	176,000	204,200	12,652	Tested wet.

BRICKS FROM THE CLARK PRESSED BRICK COMPANY, MALVERN, ARK.

Bricks by the dry press process. The press used is the Boyd patent, made by Chisholm, Boyd & White, Chicago, Ill.

BUILDING BRICK, CHOCOLATE COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7540	2.41	4.06	8.44	34.27	382,000	508,800	14,847	
7541	2.39	4.09	8.42	34.44	306,000	459,200	13,333	

FIRE BRICK, DARK BUFF COLOR.

7542	2.30	4.03	8.19	33.01	538,000	665,400	20,157	
7543	2.30	4.10	8.10	33.21	475,000	716,800	21,584	
7544	2.29	4.09	8.16	33.37	554,000	707,500	21,202	

PAVING BRICKS.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7545	No. 1	4.10	2.30	8.09	18.61	144,000	251,800	13,530	Tested on edge.
7546	No. 1	4.05	2.32	8.14	18.88	55,000	227,500	12,050	Do.
7547	No. 1	4.07	2.28	8.09	18.45	128,000	232,000	12,574	Do.

PAVING BRICKS, HAND-MADE.

7548	No. 2	3.90	2.00	8.45	16.90	46,000	89,500	5,296	Tested on edge.
7549	No. 2	3.84	2.15	8.36	17.97	36,000	56,200	3,127	Do.
7550	No. 2	3.87	2.09	8.32	17.39	29,000	79,300	4,560	Do.

No. 10 press brick, burned in patent down-draft kiln; used for face work on the outside of buildings or facing inside work of any kind.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7447	2.30	4.07	8.28	33.70	285,000	369,600	10,967	
7448	2.30	4.07	8.30	33.78	314,000	380,900	11,276	
7449	2.30	4.10	8.32	34.11	366,000	371,200	10,882	

Arch brick, burned in common kilns, the arches being built of green brick; used for foundations.

No. of test.	Dimensions.			Sectional area	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7450	2.22	3.81	8.51	32.42	303,000	361,500	11,150	
7451	2.22	3.96	8.29	32.83	228,000	369,600	11,258	
7452	2.28	3.79	8.49	32.18	230,000	311,600	9,683	

Bricks from the Powhatan Clay Manufacturing Company, Richmond, Va.

CREAM-WHITE BRICK.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7622	No. 1	2.34	3.87	8.06	31.19	148,000	197,000	6,335	
7623	No. 1	2.37	3.89	8.08	31.43	121,000	153,500	4,884	

DARK RED BRICK.

7624	No. 2	2.14	3.52	7.60	26.75	88,000	376,100	14,060	
7625	No. 2	2.13	3.59	7.74	27.79	62,000	343,600	12,364	
7626	No. 2	2.12	3.58	7.67	27.46	72,000	249,900	9,100	

LIGHT RED BRICK.

7627	No. 3	2.21	3.68	7.65	28.00	98,000	315,400	11,264	
7628	No. 3	2.16	3.58	7.53	26.96	47,000	460,800	17,092	
7629	No. 3	2.15	3.58	7.54	26.99	46,000	403,100	14,935	

Compression tests of half bricks after test by transverse loads.

CREAM WHITE NO. 1.

No. of test.	Transverse test number.	Dimensions. Height.	Compressed surface.		Sectional area.	First crack.	Ultimate strength. Total.	Per square inch.	Remarks.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7770	355	2.31	3.85	4.01	15.44	68,000	76,100	4,929	
7810	355	2.31	3.85	3.38	13.01	47,000	53,900	4,142	Tested wet.

DARK RED NO. 2.

7771	356	2.18	3.59	3.77	13.54	51,000	140,700	10,331	
7811	356	2.18	3.59	3.48	12.49	38,500	119,900	9,600	Tested wet.

LIGHT RED NO. 3.

7772	357	2.11	3.58	3.48	12.46	94,000	199,600	16,019	
7812	357	2.11	3.58	3.70	13.25	62,000	196,400	14,822	Tested wet.

CREAM WHITE NO. 4.

7773	358	2.40	3.80	6.09	23.14	101,000	102,900	4,447	
7813	358	2.40	3.80	4.26	16.19	51,800	65,600	4,052	Tested wet.
7774	359	3.80	2.38	5.36	12.76	57,800	57,800	4,530	Tested on edge.
7814	359	3.80	2.38	4.33	10.30	39,100	39,100	3,796	Tested wet on edge.

BRICKS FROM THE BROOKE TERRA COTTA COMPANY, LAZEARVILLE, W. VA.

Compression tests of half bricks after test by transverse loads.
Made by the dry-press process.
Medium dark buff No. 5.

No. of test.	Transverse test number.	Dimensions. Height.	Compressed surface.		Sectional area.	First crack.	Ultimate strength. Total.	Per square inch.	Remarks.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7782	364	2.44	4.15	4.44	18.43	221,000	225,400	11,240	

BRICKS FROM THE COALDALE BRICK AND TILE COMPANY, COALDALE, JEFFERSON COUNTY, ALA.

BUFF-COLORED PRESS BRICK.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7557	2.38	4.18	8.48	35.45	278,000	426,500	12,031	
7558	2.34	4.20	8.47	35.57	308,000	527,100	14,818	
7559	2.40	4.20	8.51	35.74	348,000	453,900	12,700	

RED-COLORED PRESS BRICK.

7560	2.39	4.00	8.32	33.28	97,900	125,300	3,765	
7561	2.42	3.96	8.30	32.87	93,000	93,100	2,832	
7562	2.30	4.55	8.25	37.54	139,000	147,600	3,932	

PAVING BRICKS.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7563	A	3.54	2.90	8.51	24.68	47,000	261,200	10,583	Tested on edge.
7564	A	3.53	2.94	8.53	25.08	28,000	212,800	8,485	Do.
7565	B	3.45	2.89	8.32	24.04	37,000	149,200	6,206	Do.
7566	B	3.45	2.83	8.22	23.26	39,000	178,100	7,657	Do.
7567	C	3.43	2.85	8.19	23.34	51,000	201,100	8,616	Do.
7568	C	3.45	2.90	8.54	24.77	63,000	200,500	9,034	Do.

Compression tests of half bricks after test by transverse loads.

VITRIFIED PAVING BRICK, A.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7778	360	3.63	2.92	3.70	10.80	21,000	171,100	15,842	Tested on edge.
7815	360	3.63	2.92	4.25	12.41	27,000	139,900	11,273	Tested wet on edge.

VITRIFIED PAVING BRICK, C.

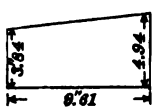
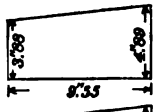
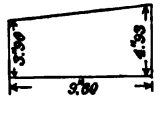
7779	361	3.61	2.89	4.03	11.65	63,000	81,500	6,996	Tested on edge.

FIRE BRICKS FROM JOHN EHARKER, ASHBY, ALA.

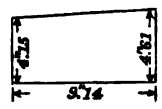
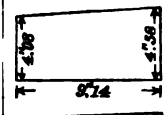
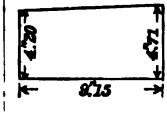
ARCH BRICK FOR COKE OVENS.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7630	No. 2	5.35	4.43	9.13	40.45	99,000	104,800	2,591	2 bricks tested together.

BULLHEAD BRICKS FOR LIMEKILNS, ETC.

7631	No. 3	2.55		42.19	117,000	140,500	3,330	
7632	No. 3	2.50		41.88	86,000	114,000	2,744	
7633	No. 3	2.65		42.38	88,000	129,800	3,063	

RIM BRICKS FOR COKE OVENS.

7634	No. 4	2.60		40.03	124,000	148,400	3,707	
7635	No. 4	2.60		39.58	91,000	152,100	3,843	
7636	No. 4	2.63		40.76	123,000	151,100	3,707	

Compression tests of half bricks after test by transverse loads.

FIRE BRICK NO. 1.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7758	343	2.54	4.26	4.58	19.51	42,900	47,100	2,414	
7804	343	2.54	4.26	3.91	16.66	28,000	31,400	1,885	Tested wet.

PLASTER OF PARIS—AGE, 10 MONTHS.

No. 1362.

Length, 24″.06.
Sectional area, 4″.06 × 5″.95 = 24.16 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,416	100	0.	0.	Initial load.
4,832	200	.0038	.....	
7,248	300	.0077	.....	
9,664	400	.0121	.....	
12,080	500	.0169	.....	
9,664	400	.0129	.....	
7,248	300	.0089	.....	E = 920,000 pounds per square inch.
4,832	200	.0047	.....	
2,416	100	.....	.0005	
4,832	200	.0043	.....	
7,248	300	.0085	.....	
9,664	400	.0126	.....	
12,080	500	.0170	.....	
9,664	400	.0130	.....	
7,248	300	.0089	.....	
4,832	200	.0046	.....	
2,416	100	.....	.0005	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5″.5 at middle of length.

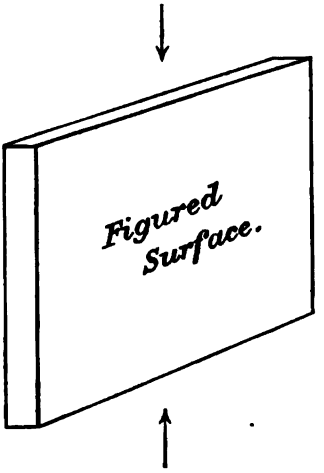
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,416	100	0.	0.	
12,080	500	.0008	.....	
2,416	100	.....	0.	
12,080	500	.0008	.....	
2,416	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{5.6}$.

NATURAL STONES.

TRANSVERSE TESTS.

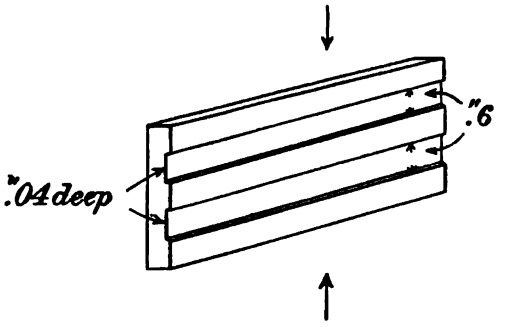
Nos. 15, 16, and 17 unglazed. Used for floors. Six-inch tiles tested on edge.



Compressed surfaces not plastered.

No. of test.	Description.		Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	No.	Color.	Height.	Compressed surface.				Total.	Per square inch.
			Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7725	15	5000 G	6.00	6.00	0.58	3.480	97,300	173,200	49,770
7726	16	5001 G	5.98	5.99	.57	3.414	43,000	167,800	49,150
7727	17	5006 G	5.99	6.00	.58	3.480	54,800	213,200	61,264

Nos. 18 and 19 glazed tiles. Used for walls and wainscoting.



Compressed surfaces not plastered.

No. of test.	Description.		Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	No.	Color.	Height.	Compressed surface.				Total.	Per square inch.
			Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7728	18	White	2.98	5.96	0.33	1.967	10,100	17,500	8,897
7729	19	Ivory	3.00	5.99	.33	1.977	7,800	24,860	12,575

BRICKS.

COMPRESSIVE ELASTIC PROPERTIES.

Bricks from Noah Hamlet Brickyard.

Made from clay and shale near Little Rock, Pulaski County, Ark.

RED BRICKS.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7578	No. 1	2.55	4.17	8.45	35.24	56,000	71,500	2,028	Soft burnt.
7579	No. 2	2.40	4.14	8.39	34.73	109,000	154,900	4,460	Medium hard burnt.
7580	No. 2	2.36	4.18	8.45	35.32	108,000	143,600	4,065	
7581	No. 3	2.52	4.04	8.33	33.65	143,000	201,500	5,988	Hard burnt.

WHITE BUILDING BRICKS.

7587	.....	2.37	4.32	8.72	37.67	106,000	168,600	4,475	
7588	.....	2.44	4.30	8.68	37.32	109,000	142,800	3,826	

PAVING BRICKS.

7582	No. 1	4.00	2.50	8.22	20.55	39,500	109,900	5,348	Tested on edge.
7583	No. 2	3.93	2.10	8.10	17.01	33,000	91,400	5,373	Do.
7584	No. 3	3.98	2.12	8.09	17.15	61,000	88,400	5,154	Do.
7585	No mark.	3.92	2.15	8.04	17.29	65,000	98,300	5,685	Do.
7586	No mark.	3.88	2.16	8.04	17.37	34,000	88,200	5,078	Do.

Bricks from Brickyard of M. D. Hunton, Fort Smith, Ark.

PAVING BRICKS.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7610	No. 1	3.76	2.29	8.06	18.46	56,000	88,600	4,800	Tested on edge.
7611	No. 1	3.78	2.18	7.97	17.37	27,000	93,200	5,366	Do.

BUILDING BRICK.

7612	"Doyle" No. 2	2.20	3.83	8.12	31.10	86,000	204,900	6,588	

VITRIFIED PAVING BRICKS FROM THE CAPITAL CITY VITRIFIED BRICK AND PAVING COMPANY, TOPEKA, KANS.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7589	3.80	2.33	7.89	18.38	34,000	139,900	7,611	Tested on edge.
7590	3.84	2.33	7.87	18.34	41,500	151,000	8,233	Do.
7591	3.79	2.32	7.85	18.21	59,000	160,100	8,792	Do.

Compression test of half brick after test by transverse loads.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7762	347	3.79	2.30	3.90	8.97	26,000	92,800	10,345	Tested on edge.

BRICKS FROM THE MONTICELLO BRICK WORKS.

[Located at Monticello, on the Mississippi River, 40 miles above Minneapolis, Minn.]

The brick are made by the dry-pressed process from the clay in its natural state, no sand or coloring matter being used—simply dried and pulverized.

PAVING BRICKS.

No of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7592	No. 1...	3.79	2.11	7.97	16.82	29,000	110,900	6,593	Tested on edge.
7593	No. 1...	3.89	2.13	7.92	16.87	101,000	365,500	21,665	Do.

FACE BRICKS.

7594	No. 2..	2.08	3.89	7.97	31.00	377,000	654,300	21,106	
7595	No. 2..	3.97	2.13	7.97	16.98	221,000	309,800	18,245	Tested on edge.

SOFT FACE BRICKS.

7596	No. 3..	2.40	4.04	8.19	33.09	248,000	279,500	8,447	
7597	No. 3..	2.36	4.04	8.14	32.89	198,000	248,100	7,543	

Compression test of half bricks after test by transverse loads.

FACE BRICK NO. 2.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7766	351	2.19	4.10	3.70	15.17	159,000	243,000	16,018	Tested wet.
7808	351	2.19	4.10	4.09	16.77	141,000	201,800	15,611	

BRICKS FROM THE KELLEY BRICK AND TILE COMPANY, MINNEAPOLIS, MINN.

Compression tests of half bricks after test by transverse loads.

LIGHT STRAW COLOR.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7783	365	2.33	3.69	4.02	14.83	73,000	95,400	6,433	
7818	365	2.33	3.69	3.74	13.80	45,000	96,500	6,992	

BRICKS FROM A. HUMPHREY, MINNEAPOLIS, MINN.

SIDE-CUT PAVING BRICK.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds*	*Pounds.*	
7598	3.98	2.27	8.23	18.68	41,000	371,100	19,866	Tested on edge.

DRIFT CLAY, SIDE-CUT PAVING BRICK.

7599	3.97	2.25	8.27	18.61	43,000	274,000	14,723	Tested on edge.

DRIFT CLAY, END-CUT PAVING BRICK.

7600	3.89	2.50	8.22	20.55	19,000	179,860	8,749	Tested on edge.

Compression tests of half bricks after test by transverse loads.

LIGHT CHOCOLATE COLOR NO. 71.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7767	352	2.28	3.96	4.65	18.41	84,000	142,200	7,724	
7809	352	2.28	3.96	3.00	11.88	51,000	83,600	7,037	Tested wet.

BUFF SPECKLED NO. 27.

7768	353	1.53	4.04	5.66	22.87	171,000	323,000	14,123	

BUFF SPECKLED NO. 33.

7769	354	1.50	4.00	5.50	22.00	142,000	382,500	17,386	

BRICKS, TILES, ETC., FROM GLADDING, MCBEAN & CO., SAN FRANCISCO, CAL.

[Front pressed clay brick. Salmon color. Process: Semi-dry machine. Soft burnt.]

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7505	2.41	4.03	8.18	32.97	202,000	341,800	10,367	
7506	2.41	4.04	8.18	33.05	281,000	288,200	8,720	
7507	2.43	4.06	8.21	33.33	265,000	304,800	9,144	

[Front pressed clay brick. Buff color. Process: Semi-dry machine. Hard burnt.]

7508	2.39	4.02	8.24	33.12	151,000	161,100	4,864	
7509	2.40	4.03	8.28	33.37	133,800	133,800	4,010	
7510	2.39	4.04	8.28	33.45	128,000	132,100	3,949	

[Front pressed clay brick. Cream color. Process: Stiff mud machine. Soft burnt.]

7511	2.39	4.23	8.45	35.74	181,000	255,200	7,140	
7512	2.38	4.25	8.52	36.21	206,000	252,000	6,959	
7513	2.39	4.18	8.45	35.32	232,000	271,900	7,698	

[Front pressed clay brick. Dark buff color. Process: Stiff mud machine. Hard burnt.]

7514	2.32	4.03	8.25	33.25	233,000	259,500	7,804	
7515	2.28	4.04	8.30	33.53	187,000	282,400	8,422	
7516	2.27	4.04	8.27	33.41	265,000	301,500	9,024	

[Fire brick. Dark buff color.]

7517	2.44	4.44	9.03	40.09	142,500	177,100	4,418	
7518	2.43	4.50	9.06	40.77	127,000	164,300	4,030	
7519	2.46	4.48	9.04	40.50	141,000	173,100	4,274	

Fire Bricks from Pacific Clay Manufacturing Company, Los Angeles, Cal.

[Works at South Riverside, Cal.]

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7684	2.38	4.10	8.05	33.00	96,000	130,500	3,954	
7685	2.34	4.20	8.22	34.52	67,000	120,400	3,488	
7686	2.38	4.25	8.35	35.49	86,000	147,200	4,148	
7687	4.10	2.30	8.11	18.65	51,000	51,200	2,745	Tested on edge.

Compression tests of half bricks after test by transverse loads.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7781	363	2.40	4.17	8.97	16.55	43,000	49,200	2,973	
7816	363	2.40	4.17	8.79	15.80	39,000	43,900	2,778	Tested wet.

Molded Granite from the New Hampshire Molded Granite Company, Keene, N. H.

Manufactured stone made from disintegrated granite mixed with clay, molded, dried, fired the same as fire brick.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7705	2.47	4.19	8.33	34.90	258,000	439,200	12,584	
7706	2.48	4.20	8.31	34.90	155,000	219,400	6,286	Edges outside of sunken panel flaked off.

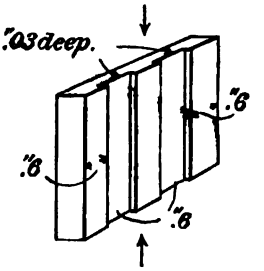
Compression test of half brick after test by transverse loads. Transverse test No. 362.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7780	2.35	4.06	4.13	16.77	37,000	153,900	9,177	

TILES FROM AMERICAN ENCAUSTIC TILING COMPANY, LIMITED, NEW YORK, N. Y.

[Works at Zanesville, Ohio.]

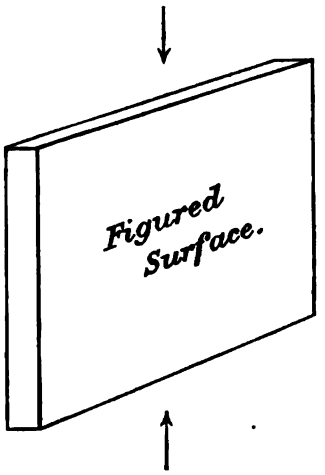
Nos. 1 to 14 unglazed. Used for floors. Three-inch tiles tested on end.



Compressed surfaces not faced with plaster of paris.

No. of test.	Description.		Dimensions.		Sectional area.	First crack.	Ultimate strength.	
	No.	Color.	Height.	Compressed surface.			Total.	Per square inch.
			Inches.	*Inches.* *Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7711	1	Buff	3.00	3.00 0.46	1.344	26,900	30,610	22,775
7712	2	Salmon	2.98	2.98 .44	1.275	25,800	53,500	41,961
7713	3	Light gray	2.98	2.98 .46	1.335	27,300	65,100	48,764
7714	4	Dark gray	2.99	2.99 .46	1.339	26,800	47,700	35,623
7715	5	Red	3.00	3.00 .49	1.434	23,200	35,650	24,860
7716	6	Chocolate	2.98	2.98 .46	1.335	29,100	47,360	35,475
7717	7	Black	2.98	2.98 .47	1.365	22,700	24,200	17,729
7731	7	.....do	2.97	2.98 .46	1.335	22,700	24,600	18,427
7718	8	White	3.00	3.00 .48	1.404	3,100	26,880	19,145
7730	8	.....do	2.99	3.00 .48	1.404	15,400	65,800	46,866
7719	9	Silver gray	2.99	2.99 .49	1.429	3,400	48,100	33,660
7720	10	Pink	2.99	2.99 .49	1.429	4,700	42,700	29,881
7721	11	Celadon	3.01	3.01 .50	1.469	2,400	72,900	49,625
7722	12	Light blue	2.99	2.99 .50	1.459	20,400	25,700	17,615
7723	13	Dark blue	2.99	2.99 .49	1.429	45,500	45,750	32,015
7724	14	Green	2.99	2.99 .47	1.369	3,200	27,800	20,307

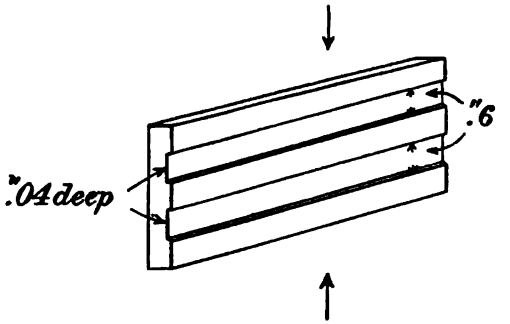
Nos. 15, 16, and 17 unglazed. Used for floors. Six-inch tiles tested on edge.



Compressed surfaces not plastered.

No. of test.	Description.		Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	No.	Color.	Height.	Compressed surface.				Total.	Per square inch.
			Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7725	15	5000 G	6.00	6.00	0.58	3.480	97,300	173,200	49,770
7726	16	5001 G	5.98	5.99	.57	3.414	43,000	167,800	49,150
7727	17	5006 G	5.99	6.00	.58	3.480	54,800	213,200	61,264

Nos. 18 and 19 glazed tiles. Used for walls and wainscoting.



Compressed surfaces not plastered.

No. of test.	Description.		Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	No.	Color.	Height.	Compressed surface.				Total.	Per square inch.
			Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7728	18	White	2.98	5.96	0.33	1.967	10,100	17,500	8,897
7729	19	Ivory	3.00	5.99	.33	1.977	7,800	24,860	12,575

BRICKS.

COMPRESSIVE ELASTIC PROPERTIES.

BRICKS.

Brick from Philadelphia and Boston Face Brick Company, Boston, Mass.

No. 1381.

Soft burnt, for inside work. Salmon color.
Length, 8″.35.
Sectional area, 2″.39 × 4″.25 = 10.15 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,015	100	0.	0.	Initial load.
2,030	200	.0015	.....	
3,045	300	.0029	.....	
4,060	400	.0044	.....	
5,075	500	.0060	.0010	
6,090	600	.0079	.....	
7,105	700	.0094	.....	
8,120	800	.0111	.....	
9,135	900	.0128	.....	
10,150	1,000	.0145	.....	E = 391,000 pounds per square inch.
8,120	800	.0131	.....	
6,090	600	.0110	.....	
4,060	400	.0085	.....	
2,030	200	.0051	.....	
1,015	100	.....	.0030	
2,030	200	.0046	.....	
4,060	400	.0077	.....	
6,090	600	.0105	.....	
8,120	800	.0128	.....	
10,150	1,000	.0152	.....	
8,120	800	.0136	.....	
6,090	600	.0115	.....	
4,060	400	.0090	.....	
2,030	200	.0055	.....	
1,015	100	.....	.0034	

Laternal expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,015	100	0.	0.	Initial load.
10,150	1,000	.0011	.....	
1,015	100	.....	0.	
10,150	1,000	.0011	.....	
1,015	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{7.3}$.

Brick from Philadelphia and Boston Face Brick Company, Boston, Mass.

No. 1382.

Soft burnt, for inside work. Salmon color.
Length, 8″.33.
Sectional area, 2″.39 × 4″.28 = 10.23 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,023	100	0.	0.	Initial load.
2,046	200	.0010	.....	
3,069	300	.0020	.....	
4,092	400	.0031	.....	
5,115	500	.0041	.0004	
6,138	600	.0052	.....	
7,161	700	.0064	.....	
8,184	800	.0077	.....	
9,207	900	.0089	.....	
10,230	1,000	.0101	.....	
8,184	800	.0087	.....	
6,138	600	.0070	.....	E = 517,000 pounds per square inch.
4,092	400	.0050	.....	
2,046	200	.0027	.....	
1,023	100	.....	.0014	
2,046	200	.0025	.....	
4,092	400	.0047	.....	
6,138	600	.0067	.....	
8,184	800	.0085	.....	
10,230	1,000	.0104	.....	
8,184	800	.0090	.....	
6,138	600	.0073	.....	
4,092	400	.0053	.....	
2,046	200	.0029	.....	
1,023	100	.....	.0015	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,023	100	0.	0.	Initial load.
10,230	1,000	.0007	.....	
1,023	100	.....	0.	
10,230	1,000	.0007	.....	
1,023	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{8.7}$.

BRICK FROM PHILADELPHIA AND BOSTON FACE BRICK COMPANY, BOSTON, MASS.

No. 1383.

Dark-red brick, for outside work.
Length, 7″.82.
Sectional area, 2″.22×3″.86 = 8.57 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
857	100	0.	0.	Initial load.
1,714	200	.0003	.....	
2,571	300	.0006	.....	
3,428	400	.0009	.....	
4,285	500	.0011	.....	
5,142	600	.0013	.....	
5,999	700	.0015	.....	
6,856	800	.0018	.....	
7,713	900	.0020	.....	
8,570	1,000	.0023	0.	
12,855	1,500	.0034	.....	
17,140	2,000	.0045	.....	
21,425	2,500	.0056	.....	
25,710	3,000	.0066	.0002	
29,995	3,500	.0077	.....	
34,280	4,000	.0085	.....	
38,565	4,500	.0089	.....	Brick thought to be yielding locally.
42,850	5,000	.0090	.....	
34,280	4,000	.0079	.....	
25,710	3,000	.0061	.....	
17,140	2,000	.0042	.....	
8,570	1,000	.0019	.....	
857	100	.....	—.0009	
8,570	1,000	.0017	.....	
17,140	2,000	.0039	.....	
25,710	3,000	.0059	.....	
34,280	4,000	.0078	.....	
42,850	5,000	.0089	.....	
34,280	4,000	.0079	.....	E = 2,190,000 pounds per square inch.
25,710	3,000	.0061	.....	
17,140	2,000	.0041	.....	
8,570	1,000	.0019	.....	
857	100	.....	—.0010	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
857	100	0.	0.	Initial load.
34,280	4,000	.0009	.....	
857	100	.....	0.	
34,280	4,000	.0009	.....	
857	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{6.9}$.

OBSERVATIONS RESUMED ON THE LONGITUDINAL COMPRESSION OF THE BRICK.

Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
857	100	.....	—.0010	Micrometer reset to former reading.
8,570	1,000	.0016	.....	
17,140	2,000	.0036	.....	
25,710	3,000	.0058	.....	
34,280	4,000	.0076	.....	
42,850	5,000	.0094	.....	
47,135	5,500	.0104	.....	
51,420	6,000	.0108	—.0009	
55,705	6,500	.0110	.....	
59,990	7,000	.0111	.....	
51,420	6,000	.0104	.....	
42,850	5,000	.0088	.....	
34,280	4,000	.0071	.....	E = 2,520,000 pounds per square inch.
25,710	3,000	.0051	.....	
17,140	2,000	.0031	.....	
8,570	1,000	.0004	.....	
857	100	.....	—.0026	
8,570	1,000	.0002	.....	
17,140	2,000	.0026	.....	
25,710	3,000	.0047	.....	
34,280	4,000	.0067	.....	
42,850	5,000	.0086	.....	
51,420	6,000	.0103	.....	
59,990	7,000	.0111	.....	
51,420	6,000	.0104	.....	
42,850	5,000	.0088	.....	
34,280	4,000	.0071	.....	
25,710	3,000	.0051	.....	
17,140	2,000	.0029	.....	
8,570	1,000	.0003	.....	
857	100	.....	—.0027	
71,200	8,308	.....	.....	Brick began to fail at one end along the narrow edge.

The load was temporarily reduced to 65,000 pounds, and when again increased rupture was completed under 70,500 pounds, or 8,226 pounds per square inch. A pyramidal fragment developed at the end first cracked, which pyramid wedged the opposite end of the brick into two principal fragments.

The end first cracked seemed to be the softer end, as shown during the process of grinding the end faces.

Brick from Philadelphia and Boston Face Brick Company, Boston, Mass.

No. 1384.

Cream-colored brick, for outside work.
Length, 7″.98.
Sectional area, 2″.28×3″.92=8.94 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
894	100	0.	0.	Initial load.
1,788	200	.0009	.....	
2,682	300	.0016	.....	
3,576	400	.0026	.....	
4,470	500	.0035	.....	
5,364	600	.0044	.....	
6,258	700	.0053	.....	
7,152	800	.0064	.....	
8,046	900	.0076	.....	
8,940	1,000	.0087	.....	
894	100	.....	.0012	
1,788	200	.0021	.....	
3,576	400	.0040	.....	
5,364	600	.0057	.....	
7,152	800	.0073	.....	
8,940	1,000	.0090	.....	E=577,000 pounds per square inch.
7,152	800	.0079	.....	
5,364	600	.0063	.....	
3,576	400	.0046	.....	
1,788	200	.0026	.....	
894	100	.....	.0012	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expension.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
894	100	0.	0.	Initial load.
8,940	1,000	.0010	.....	
894	100	.....	0.	
8,940	1,000	.0010	.....	
894	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{5.5}$.

BRICK FROM PHILADELPHIA AND BOSTON FACE BRICK COMPANY, BOSTON, MASS.

No. 1385.

Buff-colored brick, for outside work.
Length, 7.83″.
Sectional area, 2.25″×3.97″=8.93 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
893	100	0.	0.	Initial load.
1,786	200	.0001	.....	
2,679	300	.0002	.....	
3,572	400	.0003	.....	
4,465	500	.0005	.....	
5,358	600	.0007	.....	
6,251	700	.0009	.....	
7,144	800	.0011	.....	
8,037	900	.0012	.....	
8,930	1,000	.0014	0.	
13,395	1,500	.0024	.....	
17,860	2,000	.0034	.....	
22,325	2,500	.0044	.....	
26,790	3,000	.0053	0.	
31,255	3,500	.0064	.....	
35,720	4,000	.0075	.....	
40,185	4,500	.0085	.....	
44,650	5,000	.0097	.....	E=2,570,000 pounds per square inch.
35,720	4,000	.0081	.....	
26,790	3,000	.0062	.....	
17,860	2,000	.0042	.....	
8,930	1,000	.0021	.....	
893	100	.....	.0002	
8,930	1,000	.0019	.....	
17,860	2,000	.0040	.....	
26,790	3,000	.0060	.....	
35,720	4,000	.0080	.....	
44,650	5,000	.0099	.....	
35,720	4,000	.0082	.....	
26,790	3,000	.0063	.....	
17,860	2,000	.0043	.....	
8,930	1,000	.0021	.....	
893	100	.....	.0002	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
893	100	0.	0.	Initial load.
44,650	5,000	.0010	.....	
893	100	.....	0.	
44,650	5,000	.0011	.....	
893	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{3.5}$.

BRICK FROM PHILADELPHIA AND BOSTON FACE BRICK COMPANY, BOSTON, MASS.

No. 1386.

Chocolate-brown color, for outside work.
Length, 7″.65.
Sectional area, 2″.15 × 3.87″ = 8.32 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
832	100	0.	0.	Initial load.
1,664	200	.0003	.....	
2,496	300	.0005	.....	
3,328	400	.0006	.....	
4,160	500	.0008	.....	
4,992	600	.0009	.....	
5,824	700	.0010	.....	
6,656	800	.0011	.....	
7,488	900	.0012	.....	
8,320	1,000	.0013	.0001	
12,480	1,500	.0019	.....	
16,640	2,000	.0024	.....	
20,800	2,500	.0029	.....	
24,960	3,000	.0034	.0002	
29,120	3,500	.0039	.....	
33,280	4,000	.0043	.....	
37,440	4,500	.0048	.....	
41,600	5,000	.0053	.0003	
45,760	5,500	.0058	.....	
49,920	6,000	.0063	.....	
54,080	6,500	.0068	.....	
58,240	7,000	.0073	.....	E = 5,000,000 pounds per square inch.
49,920	6,000	.0064	.....	
41,600	5,000	.0055	.....	
33,280	4,000	.0045	.....	
24,960	3,000	.0036	.....	
16,640	2,000	.0025	.....	
8,320	1,000	.0014	.....	
832	100	.....	.0004	
8,320	1,000	.0014	.....	
16,640	2,000	.0025	.....	
24,960	3,000	.0035	.....	
33,280	4,000	.0045	.....	
41,600	5,000	.0054	.....	
49,920	6,000	.0064	.....	
58,240	7,000	.0074	.0004	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
832	100	0.	0.	Initial load.
58,240	7,000	.0008	.....	
832	100	.....	0.	
58,240	7,000	.0008	.....	
832	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{6}$.

BRICK FROM THE EASTERN HYDRAULIC PRESS BRICK COMPANY, PHILADELPHIA, PA.

No. 1365.

Shade, 200.
Length, 8″.10.
Sectional area, 2″.25×4″.01=9.02 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
902	100	0.	0.	Initial load.
1,804	200	.0001	.....	
2,706	300	.0004	.....	
3,608	400	.0005	.....	
4,510	500	.0008	.....	
5,412	600	.0010	.....	
6,314	700	.0012	.....	
7,216	800	.0014	.....	
8,118	900	.0017	.....	
9,020	1,000	.0019	0.	
13,530	1,500	.0032	.....	
18,040	2,000	.0042	.0002	
22,550	2,500	.0054	.....	
27,060	3,000	.0066	.0003	
31,570	3,500	.0078	.....	
36,080	4,000	.0091	.0005	
40,590	4,500	.0105	.....	
45,100	5,000	.0118	.0006	
49,610	5,500	.0132	.....	
54,120	6,000	.0145	.....	
45,100	5,000	.0132	.....	
36,080	4,000	.0110	.....	
27,060	3,000	.0088	.....	
18,040	2,000	.0064	.....	
9,020	1,000	.0036	.....	
902	100	.....	.0009	
9,020	1,000	.0033	.....	
18,040	2,000	.0059	.....	
27,060	3,000	.0083	.....	
36,080	4,000	.0106	.....	
45,100	5,000	.0128	.....	
54,120	6,000	.0149	.....	E = 2,120,000 pounds per square inch.
45,100	5,000	.0133	.....	
36,080	4,000	.0113	.....	
27,060	3,000	.0091	.....	
18,040	2,000	.0065	.....	
9,020	1,000	.0037	.....	
902	100	.....	.0010	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
902	100	0.	0.	Initial load.
54,120	6,000	.0011	.....	
902	100	.....	0.	
54,120	6,000	.0011	.....	
902	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{3.5}$.

BRICK FROM THE EASTERN HYDRAULIC PRESS BRICK COMPANY, PHILADELPHIA, PA.

No. 1366.

Shade, 300.
Length, 8″.07.
Sectional area, 2″.19×4″.05=8.87 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
887	100	0.	0.	Initial load.
1,774	200	.0004	.....	
2,661	300	.0007	.....	
3,548	400	.0010	.....	
4,435	500	.0012	.....	
5,322	600	.0014	.....	
6,209	700	.0018	.....	
7,096	800	.0020	.....	
7,983	900	.0023	.....	
8,870	1,000	.0026	.0001	
13,305	1,500	.0040	.....	
17,740	2,000	.0053	.0004	
22,175	2,500	.0067	.....	
26,610	3,000	.0080	.0006	
31,045	3,500	.0093	.....	
35,480	4,000	.0084	—.0010	
8,870	1,000	.0017	.....	
17,740	2,000	.0045	.....	
26,610	3,000	.0070	.....	
35,480	4,000	.0084	.....	
26,610	3,000	.0072	.....	
17,740	2,000	.0048	.....	E=2,050,000 pounds per square inch.
8,870	1,000	.0020	.....	
887	100	.....	—.0011	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
887	100	0.	0.	Initial load.
35,480	4,000	.0011	.....	
887	100	.....	0.	
35,480	4,000	.0011	.....	
887	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{8}$.

Brick from Eastern Hydraulic Press Brick Company, Philadelphia, Pa.

No. 1367.

Shade, 410.
Length, 8″.16.
Sectional area, 2″.23 × 3″.97 = 8.85 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
885	100	0.	0.	Initial load.
1,770	200	.0002	.....	
2,655	300	.0005	.....	
3,540	400	.0007	.....	
4,425	500	.0009	.....	
5,310	600	.0011	.....	
6,195	700	.0014	.....	
7,080	800	.0016	.....	
7,965	900	.0018	.....	
8,850	1,000	.0020	0.	
13,275	1,500	.0033	.....	
17,770	2,000	.0044	.0001	
22,125	2,500	.0057	.....	
26,550	3,000	.0069	.0003	
30,975	3,500	.0082	.....	
35,400	4,000	.0094	.0005	
39,825	4,500	.0107	.....	
44,250	5,000	.0121	.....	
35,400	4,000	.0105	.....	
26,550	3,000	.0084	.....	
17,770	2,000	.0060	.....	
8,850	1,000	.0035	.....	
885	100	.....	.0007	
8,850	1,000	.0031	.....	
17,770	2,000	.0055	.....	
26,550	3,000	.0080	.....	
35,400	4,000	.0102	.....	
44,250	5,000	.0121	.....	
35,400	4,000	.0106	.....	
26,550	3,000	.0085	.....	
17,770	2,000	.0062	.....	E = 2,170,000 pounds per square inch.
8,850	1,000	.0035	.....	
885	100	.....	.0008	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
885	100	0.	0.	Initial load.
44,250	5,000	.0014	.....	
885	100	.....	0.	
44,250	5,000	.0014	.....	
885	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{5.6}$.

BRICK FROM THE POWHATAN CLAY MANUFACTURING COMPANY, RICHMOND, VA.

No. 1378.

Cream-white brick No. 1.
Length, 8″.03.
Sectional area, 2″.41 × 3″.89 = 9.37 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
937	100	0.	0.	Initial load.
1,874	200	.0003	.....	
2,811	300	.0007	.....	
3,748	400	.0010	.....	
4,685	500	.0013	.....	
5,622	600	.0016	.....	
6,559	700	.0019	.....	
7,496	800	.0022	.....	
8,433	900	.0024	.....	
9,370	1,000	.0028	.0001	
11,244	1,200	.0034	.....	
13,118	1,400	.0040	.....	
14,992	1,600	.0045	.....	
16,866	1,800	.0051	.....	
18,740	2,000	.0057	.....	E = 1,730,000 pounds per square inch.
9,370	1,000	.0032	.....	
937	100	.....	.0002	
9,370	1,000	.0031	.....	
18,740	2,000	.0058	.....	
937	100	.....	.0003	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
937	100	0.	0.	Initial load.
18,740	2,000	.0007	.....	
937	100	.....	0.	
18,740	2,000	.0007	.....	
937	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{5.5}$.

BRICK FROM THE POWHATAN CLAY MANUFACTURING COMPANY, RICHMOND, VA.

No. 1377.

Red brick No. 2.
Length, 7″.63.
Sectional area, 2″.21×3″.58=7.91 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
791	100	0.	0.	Initial load.
1,582	200	.0001	.....	
2,373	300	.0002	.....	
3,164	400	.0003	.....	
3,955	500	.0005	.....	
4,746	600	.0006	.....	
5,537	700	.0008	.....	
6,328	800	.0009	.....	
7,119	900	.0011	.....	
7,910	1,000	.0012	.0001	
11,865	1,500	.0021	.....	
15,820	2,000	.0029	.0001+	
19,775	2,500	.0038	.....	
23,730	3,000	.0045	.....	
27,685	3,500	.0055	.....	
31,640	4,000	.0064	.0005	
35,595	4,500	.0075	.....	
39,550	5,000	.0084	.....	E=3,180,000 pounds per square inch.
31,640	4,000	.0072	.....	
23,730	3,000	.0058	.....	
15,820	2,000	.0042	.....	
7,910	1,000	.0024	.....	
791	100	.....	.0007	
7,910	1,000	.0022	.....	
15,820	2,000	.0040	.....	
23,730	3,000	.0056	.....	
31,640	4,000	.0071	.....	
39,550	5,000	.0086	.....	
31,640	4,000	.0074	.....	
23,730	3,000	.0059	.....	
15,820	2,000	.0043	.....	
7,910	1,000	.0025	.....	
791	100	.....	.0007	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
791	100	0.	0.	Initial load.
39,550	5,000	.0023	.....	
791	100	.....	0.	
39,550	5,000	.0024	.....	
791	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{2.3}$

Lateral expansion observations repeated with gauged length of 3″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
791	100	0.	0.	Initial load.
39,550	5,000	.0023	.....	
791	100	.....	.0001	
39,550	5,000	.0024	.....	
791	100	.....	.0001	

Transverse gauged length, 3″ near opposite end of brick, end B.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
791	100	0.	0.	Initial load.
39,550	5,000	.0012	.....	
791	100	.....	0.	
39,550	5,000	.0012	.....	
791	100	.....	0.	

Gauged length, 3″, $\frac{7}{8}$″ from end B.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
791	100	0.	0.	Initial load.
39,550	5,000	.0007	.....	
791	100	.....	0.	
39,550	5,000	.0007	.....	
791	100	.....	0.	

Gauged length, 3″ near middle of length of brick.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
791	100	0.	0.	Initial load
39,550	5,000	.0026	.....	
791	100	.....	.0001	
39,550	5,000	.0026	.....	
791	100	.....	.0001	

Gauged length, 3″, $\frac{7}{8}$″ from end A.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
791	100	0.	0.	Initial load.
39,550	5,000	.0018	.....	
791	100	.....	0.	
39,550	5,000	.0018	.....	
.....	100	.....	0.	

End A was evidently the weaker of the two; during the test a small piece flaked off the corner near this end.

Brick from the Brooke Terra Cotta Company, Lazearville, W. Va.

No. 1375.

Columbian buff No. 4.
Length, 8″.49.
Sectional area, 2″.44 × 4″.05 = 9.88 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
988	100	0.	0.	Initial load.
1,976	200	.0001	.....	
2,964	300	.0003	.....	
3,952	400	.0004	.....	
4,940	500	.0006	.....	
5,928	600	.0007	.....	
6,916	700	.0008	.....	
7,904	800	.0009	.....	
8,892	900	.0011	.....	
9,880	1,000	.0012	0.	
14,820	1,500	.0018	.....	
19,760	2,000	.0025	.....	
24,700	2,500	.0031	.....	
29,640	3,000	.0037	0.	
34,580	3,500	.0044	.....	
39,520	4,000	.0049	.....	
44,460	4,500	.0056	.....	
49,400	5,000	.0061	0.	
54,340	5,500	.0067	.....	
59,280	6,000	.0074	.....	
64,220	6,500	.0079	.....	
69,160	7,000	.0085	.....	
74,100	7,500	.0092	.....	
69,160	7,000	.0086	.....	
59,280	6,000	.0075	.....	
49,400	5,000	.0063	.....	
39,520	4,000	.0051	.....	E = 4,060,000 pounds per square inch.
29,640	3,000	.0039	.....	
19,760	2,000	.0027	.....	
9,880	1,000	.0014	.....	
988	100	.....	.0001	
9,880	1,000	.0013	.....	
19,760	2,000	.0027	.....	
29,640	3,000	.0039	.....	
39,520	4,000	.0051	.....	
49,400	5,000	.0062	.....	

No. 1375—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
59,280	6,000	0.0075	.....	
69,160	7,000	.0086	.....	
59,280	6,000	.0075	.....	
49,400	5,000	.0063	.....	
39,520	4,000	.0051	.....	
29,640	3,000	.0039	.....	
39,520	4,000	.0051	.....	
49,400	5,000	.0062	.....	
59,280	6,000	.0075	.....	
69,160	7,000	.0086	.....	
59,280	6,000	.0075	.....	
49,400	5,000	.0063	.....	
39,520	4,000	.0051	.....	
29,640	3,000	.0039	.....	
19,760	2,000	.0027	.....	
9,880	1,000	.0013	.....	
988	100	.....	.0002	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
988	100	0.	0.	Initial load.
69,160	7,000	.0010	.....	
988	100	.....	0.	
69,160	7,000	.0010	.....	
988	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{5.5}$.

SANDSTONE.

Contributed by William F. Myers, of San Francisco, Cal. From the Piedmont quarry, located about 5½ miles from Oakland, Alameda County, Cal.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
310	*Inches.* 4.00×5.99×2	*Sq. in.* 48.64	*Pounds.* 26,200	*Pounds.* 79,100	*Pounds.* 1,626	One.

SANDSTONE.

Contributed by R. S. Littlefield, of Bandore, Coos County, Oreg. Stones marked "Coquille River, Coos Co., Oregon."

BLUE COLOR.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
292	*Inches.* 4.00×5.95×2	*Sq. in.* 47.60	*Pounds.* 19,900	*Pounds.* 59,400	*Pounds.* 1,248	One.

SANDSTONE.

Contributed by George E. Huggins, of Olympia, Wash. From the Olympia sandstone quarry, Olympia, Thurston County, Wash.

BLUE COLOR.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
293	*Inches.* 4.01×5.99×2	*Sq. in.* 48.04	*Pounds.* 27,500	*Pounds.* 75,100	*Pounds.* 1,563	One.
294	4.04×6.00×2	48.48	33,700	83,500	1,722	One.

BRICK FROM THE CHICAGO HYDRAULIC PRESS BRICK COMPANY, CHICAGO, ILL.

No. 1368.

Red brick.
Length, 8″.07.
Sectional area, 2″.24×4″.02=9.00 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
900	100	0.	0.	Initial load.
1,800	200	.0005	.....	
2,700	300	.0010	.....	
3,600	400	.0013	.....	
4,500	500	.0017	.....	
5,400	600	.0022	.....	
6,300	700	.0027	.....	
7,200	800	.0031	.....	
8,100	900	.0036	.....	
9,000	1,000	.0040	.0003	
13,500	1,500	.0058	.....	
18,000	2,000	.0078	.0005	
22,500	2,500	.0096	.....	
27,000	3,000	.0112	.....	
18,000	2,000	.0086	.....	
9,000	1,000	.0050	.....	
900	100	.....	.0008	
9,000	1,000	.0047	.....	
18,000	2,000	.0084	.....	
27,000	3,000	.0112	.....	E=1,410,000 pounds per square inch.
18,000	2,000	.0087	.....	
9,000	1,000	.0051	.....	
900	100	.....	.0009	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
900	100	0.	0.	Initial load.
27,000	3,000	.0012	.....	
900	100	.....	0.	
27,000	3,000	.0012	.....	
900	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{4}$.

EXPANSION OF STONES.

TABLE SHOWING THE EFFECT OF TREATMENT OF STONES IN WATER AND AIR AT DIFFERENT TEMPERATURES.

Description of stone.			Treatment.	Temperature.	Gauged length.	Coefficient of expansion.
Name.	Location of quarry.	Owner.				
				° *F.*	*Inches.*	*Inch.*
Granite, light stone	Near Little Rock, Ark	John S. Braddock, Little Rock, Ark.	Open air	65	19.9939	
			Snow 22 hours	32	19.9927	
			Cold water 47 hours	32	19.9930	
			Hot water	212	20.0101	.00000341
			Cold water	32	19.9978	
Granite, dark stone	do	do	Open air	65	20.0057	
			Snow 22 hours	32	20.0136	
			Cold water 43 hours	32	20.0136	
			Hot water	212	20.0270	
			Cold water	32	20.0142	
			Hot water	212	20.0277	.00000324
			Cold water	32	20.0160	
Granite, "White Rock Mountain."	Millbridge, Me	S. L. Treat & Son, Bar Harbor, Me.	Open air	65	20.0040	
			Cold water	33	20.0026	
			Hot water	212	20.0202	.00000400
			Cold water	32	20.0058	
Granite, light broad rock	Chesterfield County, Va	J. H. Middendorf, Manchester, Va.	Out of doors 16 hours	−4 to +6	20.0047	
			Open air	65	20.0070	
			Snow 16 hours	30	20.0061	
			Cold water 45 hours	32	20.0054	
			Hot water	212	20.0246	.00000402
			Cold water	32	20.0101	
Granite, light	Korah Station, Va	Richmond Granite Co., Richmond, Va.	Open air	65	19.9937	
			Snow 22 hours	32	19.9928	
			Cold water 42 hours	32	19.9937	
			Hot water	212	20.0131	.00000431
			Cold water	32	19.9976	
Do	Exeter, Tulare County, Cal	Rocky Point Granite Works, Exeter, Cal.	Open air	65	19.9922	
			Snow 16 hours	30	19.9919	
			Cold water 18 hours	32	19.9925	
			Hot water	212	20.0110	.00000461
			Cold water	32	19.9944	
Granite, mottled	Rockville, Stearns County, Minn	Rockville Granite Co., Rockville, Minn.	Open air	65	19.9970	
			Snow 16 hours	30	19.9970	
			Cold water 21 hours	32	19.9964	
			Hot water	212	20.0108	.00000107
			Cold water	32	19.9978	
Granite, red	Sioux Falls, Minn	Drake Co., St. Paul, Minn.	Open air	65	19.9966	

BRICK FROM THE KANSAS CITY HYDRAULIC PRESS BRICK COMPANY, KANSAS CITY, MO.

No. 1373.

Red brick No. 1.
Length, 8″.28.
Sectional area, 2″.38 × 4″.03 = 9.59 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
950	100	0.	0.	Initial load.
1,918	200	.0004	.....	
2,877	300	.0007	.....	
3,836	400	.0010	.....	
4,795	500	.0014	.....	
5,754	600	.0016	.....	
6,713	700	.0020	.....	
7,672	800	.0022	.....	
8,631	900	.0025	.....	
9,590	1,000	.0029	.0002	
14,385	1,500	.0044	.....	
19,180	2,000	.0059	.0003	
24,975	2,500	.0077	.....	
28,770	3,000	.0093	.0004	
33,565	3,500	.0108	.....	
38,360	4,000	.0123	.....	
28,770	3,000	.0101	.....	
19,180	2,000	.0072	.....	
9,590	1,000	.0040	.....	
950	100	.....	.0007	
9,590	1,000	.0038	.....	
19,180	2,000	.0069	.....	
28,770	3,000	.0099	.....	
38,360	4,000	.0125	.....	
28,770	3,000	.0102	.....	
19,180	2,000	.0074	.....	E = 1,650,000 pounds per square inch.
9,590	1,000	.0041	.....	
950	100	.....	.0007	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
950	100	0.	0.	Initial load.
38,360	4,000	.0011	.....	
950	100	.....	0.	
38,360	4,000	.0011	.....	
950	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{7.5}$.

BRICK FROM THE KANSAS CITY HYDRAULIC PRESS BRICK COMPANY, KANSAS CITY, MO.

No. 1374.

Red brick No. 2.
Length, 8″.23.
Sectional area, 2″.28×4″.11=9.37 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
937	100	0.	0.	Initial load.
1,874	200	.0003	.....	
2,811	300	.0005	.....	
3,748	400	.0007	.....	
4,685	500	.0010	.....	
5,622	600	.0012	.....	
6,559	700	.0015	.....	
7,496	800	.0018	.....	
8,433	900	.0020	.....	
9,370	1,000	.0023	.0001	
14,055	1,500	.0036	.....	
18,740	2,000	.0048	.0002	
23,425	2,500	.0060	.....	
28,110	3,000	.0073	.0004	
32,795	3,500	.0084	.....	
37,480	4,000	.0097	.....	
28,110	3,000	.0078	.....	
18,740	2,000	.0054	.....	
9,370	1,000	.0029	.....	
937	100	.....	.0004	
9,370	1,000	.0026	.....	
18,740	2,000	.0052	.....	
28,110	3,000	.0076	.....	
37,480	4,000	.0098	.....	
42,165	4,500	.0109	.....	
46,850	5,000	.0120	.....	
37,480	4,000	.0101	.....	
28,110	3,000	.0080	.....	
18,740	2,000	.0055	.....	
9,370	1,000	.0030	.....	
937	100	.....	.0005	
9,370	1,000	.0028	.....	
18,740	2,000	.0053	.....	
28,110	3,000	.0078	.....	
37,480	4,000	.0100	.....	
46,850	5,000	.0121	.....	
37,480	4,000	.0102	.....	
28,110	3,000	.0080	.....	E=2,130,000 pounds per square inch.
18,740	2,000	.0056	.....	
9,370	1,000	.0030	.....	
937	100	.....	.0006	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
937	100	0.	0.	Initial load.
46,850	5,000	.0012	.....	
937	100	.....	0.	
46,850	5,000	.0012	.....	
937	100	.....	0.+	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{3.7}$.

BRICK FROM THE HYDRAULIC PRESS BRICK COMPANY, ST. LOUIS, MO.

No. 1370.

Medium red color.
Length, 8″.36.
Sectional area, 2″.24×4″.16=9.32 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
932	100	0.	0.	Initial load.
1,864	200	.0008	.....	
2,796	300	.0015	.....	
3,728	400	.0023	.....	
4,660	500	.0030	.....	
5,592	600	.0037	.....	
6,524	700	.0045	.....	
7,456	800	.0052	.....	
8,388	900	.0059	.....	
9,320	1,000	.0067	.0003	
13,980	1,500	.0105	.....	
18,640	2,000	.0142	.....	
13,980	1,500	.0117	.....	
9,320	1,000	.0086	.....	
4,660	500	.0048	.....	
932	100	.....	.0011	
4,660	500	.0045	.....	
9,320	1,000	.0082	.....	
13,980	1,500	.0115	.....	
18,640	2,000	.0145	.....	
13,980	1,500	.0120	.....	
9,320	1,000	.0087	.....	E=714,000 pounds per square inch.
4,660	500	.0050	.....	
932	100	.....	.0012	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
932	100	0.	0.	Initial load.
18,640	2,000	.0012	.....	
932	100	.....	0.	
18,640	2,000	.0012	.....	
932	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{7.7}$.

BRICK FROM THE HYDRAULIC PRESS BRICK COMPANY, ST. LOUIS, MO.

No. 1371.

Light chocolate color.
Length, 8″.18.
Sectional area, 2″.31 × 4″.06 = 9.38 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
938	100	0.	0.	Initial load.
1,876	200	.0002	.....	
2,814	300	.0005	.....	
3,752	400	.0006	.....	
4,690	500	.0008	.....	
5,628	600	.0011	.....	
6,566	700	.0012	.....	
7,504	800	.0014	.....	
8,442	900	.0016	.....	
9,380	1,000	.0018	.0001	
14,070	1,500	.0027	.....	
18,760	2,000	.0036	.0001	
23,450	2,500	.0045	.....	
28,140	3,000	.0055	.0002	
32,830	3,500	.0065	.....	
37,520	4,000	.0077	.0003	
42,210	4,500	.0088	.....	
46,900	5,000	.0101	.....	
37,520	4,000	.0085	.....	
28,140	3,000	.0067	.....	
18,760	2,000	.0047	.....	
9,380	1,000	.0026	.....	
938	100	.....	.0005	
9,380	1,000	.0024	.....	
18,760	2,000	.0044	.....	
28,140	3,000	.0063	.....	
37,520	4,000	.0083	.....	
46,900	5,000	.0102	.....	
37,520	4,000	.0086	.....	
28,140	3,000	.0069	.....	E 2,550,000 pounds per square inch.
18,760	2,000	.0048	.....	
9,380	1,000	.0027	.....	
938	100	.....	.0006	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
938	100	0.	0.	Initial load.
46,900	5,000	.0009	.....	
938	100	.....	0.	
46,900	5,000	.0009	.....	
938	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{7.1}$.

Brick from the Hydraulic Press Brick Company, St. Louis, Mo.

No. 1372.

Dark buff, speckled.
Length, 8″.32.
Sectional area, 2″.33 × 4″.17 = 9.72 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
972	100	0.	0.	Initial load.
1,944	200	.0005	.....	
2,916	300	.0010	.....	
3,888	400	.0015	.....	
4,860	500	.0021	.....	
5,832	600	.0025	.....	
6,804	700	.0030	.....	
7,776	800	.0036	.....	
8,748	900	.0040	.....	
9,720	1,000	.0045	.0002	
14,580	1,500	.0073	.....	
19,440	2,000	.0102	.0008	
24,300	2,500	.0137	.....	
29,160	3,000	.0174	.....	
24,300	2,500	.0162	.....	
19,440	2,000	.0140	.....	
14,580	1,500	.0116	.....	
9,720	1,000	.0087	.....	
4,860	500	.0051	.....	
972	100	.....	.0021	
4,860	500	.0046	.....	
9,720	1,000	.0078	.....	
14,580	1,500	.0107	.....	
19,440	2,000	.0135	.....	
24,300	2,500	.0160	.....	
29,160	3,000	.0187	.....	
24,300	2,500	.0172	.....	
19,440	2,000	.0148	.....	E = 890,000 pounds per square inch.
14,580	1,500	.0125	.....	
9,720	1,000	.0095	.....	
4,860	500	.0058	.....	
972	100	.....	.0024	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5 at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
972	100	0.	0.	
29,160	3,000	.0027	.....	
972	100	.....	.0001	
29,160	3,000	.0029	.....	
972	100	.....	.0002	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{4.5}$

Table showing the effect of treatment of stones in water and air at different temperatures—Continued.

Description of stone.			Treatment.	Temperature.	Gauged length.	Coefficient of expansion.
Name.	Location of quarry.	Owner.				
				° *F.*	*Inches.*	*Inch.*
Sandstone, blue	Thurston County, Wash.	The Tenino Stone Quarry Co., Tenino, Wash.	Open air	66	19.9999	
			Snow 40 hours	27	19.9975	
			Cold water 20 hours	32	20.0055	
			Hot water	212	20.0336	
			Cold water; 2″ of gauged length in frozen water.	32	20.0203	
			Hot water	212	20.0368	.00000347
			Cold water	32	20.0238	

CHEMICAL ANALYSES OF NATURAL STONES, BRICKS, AND TILE.

Name of stone.	SiO_2.	Fe_2O_3.	Al_2O_3.	Ca O.	Mg O.	Na_2O.	K_2O.	SO_3.	P_2O_5.	TiO_2.	CO_2.	Mn O.	Loss on ignition.	Loss.
Granite:														
Broad Rock Quarry, Chesterfield County, Va.	80.00	2.77	15.50	1.02	0.15								0.48	0.08
Korah Station, Va	71.98	1.34	16.63	2.15	0.10	3.15	4.62							
Exeter, Tulare County, Cal	75.35	3.94	13.69	2.97	0.06	1.14	2.85							
Rockville, Stearns County, Minn	72.55	2.20	15.92	2.67	0.13	2.50	4.03							
Sioux Falls red, Minnesota	70.10	3.15	16.93	1.63	0.09	0.76	7.32							
Jasper:														
Sioux Falls, Minn	98.41	1.42		0.17	Trace.									
Marble:														
Rutland white, Vermont	1.78	0.86		53.05	1.95			0.55			41.79			
Rutland blue, Vermont	0.63	0.22		55.26	0.18			Trace.			43.65			
Sutherland Falls, Vt	1.63	0.25		54.41	0.62						43.00			
Fossiliferous, St. Joe, Ark	1.42	2.95		53.30	0.20				0.01		42.08			
Richville white, De Kalb, N. Y	4.04		1.64	33.91	16.49						43.92			
Limestone:														
Isle LaMotte, Vt	1.29	1.12		54.56	0.18			Trace.			42.87			
Wasioja, Dodge County, Minn	4.97	1.49		8.07	37.60						47.83			
Darlington, Rockwood, Ill	0.50	1.45		54.20	1.23						42.61			
Bedford, Washington County, Ind.—														
Blue	1.15	1.91		53.25	1.24						42.40			
Buff	0.77	0.63	3.00	52.85	1.18						41.54			
Junction City, Kans	3.06		4.53	51.70	0.56						40.14			
Beaver, Carroll County, Ark	10.46	1.25		27.97	18.33						41.95			
Sandstone:														
New England Brown, Cromwell, Conn	62.47	3.65	10.70	10.25	0.53	2.20	4.15				6.00			
Jasper, Ala	78.58	2.54	15.19	None.	0.65						3.00			
Kettle River, Pine County, Minn	97.10		2.20	0.60	0.10									
Cabin Creek, Johnson County, Ark	91.56	1.25	5.88	0.70	0.20							0.18		
Bandera, Redfield, Kans	77.32	3.40	9.45	2.00	Trace.	2.72	0.67				4.30	0.16		
Piedmont, Alameda County, Cal	70.29	3.94	16.61	3.01							3.00			
Coquille River, Coos County, Oreg	60.35	6.86	25.00	3.12	2.13					1.54	0.90	0.10		
Tenino, Thurston County, Wash	67.25	4.57	18.81	6.13	0.10						3.04			
Bricks:														
Bay State Brick Co., Boston, Mass., hard burnt, red	62.10	9.65	20.35	7.82	0.12									
Brush & Schmidt, Buffalo, N. Y., pressed brick, No. 2	68.50	6.86	21.55	3.04	0.09									
Superior Brick Co., Rockford, Ill., hard burnt, No. 1	55.25	3.63	20.02	19.30	1.75									
Tile:														
American Encaustic Tiling Co., N. Y., white, 5006 G	62.70	trace.	35.48	1.65	0.15									

Lateral expansion under endwise compression loads.
Transverse gauged length, 3.5″ at middle of length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
950	100	0.	0.	Initial load.
38,000	4,000	.0034	.....	
950	100	.....	.0002	
38,000	4,000	.0035	.....	
950	100	.....	.0002	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{4}$.

BRICK FROM GLADDING, MCBEAN & CO., SAN FRANCISCO, CAL.

No. 1379.

Front pressed brick semi-dry machine. Soft burnt. Salmon color.
Length, 8″.14.
Sectional area, 2″.43 × 4″.07 = 9.89 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
989	100	0.	0.	Initial load.
1,978	200	.0002	.....	
2,967	300	.0005	.....	
3,956	400	.0006	.....	
4,945	500	.0009	.....	
5,934	600	.0011	.....	
6,923	700	.0014	.....	
7,912	800	.0016	.....	
8,901	900	.0018	.....	
9,890	1,000	.0021	0.	
14,835	1,500	.0035	.....	
19,780	2,000	.0047	.....	
24,725	2,500	.0064	.....	
29,670	3,000	.0080	.0004	
34,615	3,500	.0099	.....	
39,560	4,000	.0117	.....	E = 1,770,000 pounds per square inch.
29,670	3,000	.0096	.....	
19,780	2,000	.0069	.....	
9,890	1,000	.0037	.....	
989	100	.....	.0007	
9,890	1,000	.0035	.....	
19,780	2,000	.0065	.....	
29,670	3,000	.0093	.....	
39,560	4,000	.0122	.....	E = 2,290,000 pounds per square inch.
29,670	3,000	.0099	.....	
19,780	2,000	.0071	.....	
9,890	1,000	.0039	.....	
989	100	.....	.0008	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
989	100	0.	0.	Initial load.
39,560	4,000	.0024	.....	
989	100	.....	.0001	
39,560	4,000	.0027	.....	
989	100	.....	.0002	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{2.8}$.
Observations made 1″ from end A.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
989	100	0.	0.	Initial load.
39,560	4,000	.0023	.....	
989	100	.....	.0002	
39,560	4,000	.0025	.....	
989	100	.....	.0003	

Observations made 1″ from end B.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
989	100	0.	0.	Initial load.
39,560	4,000	.0007	.....	
989	100	.....	0.	
39,560	4,000	.0007	.....	
989	100	.....	0.	

Observations made 2″ from end B.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
989	100	0.	.....	Initial load.
39,560	4,000	.0000	.....	
989	100	.....	.0001	
39,560	4,000	.0009	.....	
989	100	.....	.0001	

Tabulation of results of compression, transverse, and shearing tests, and coefficients of expansion in water—Continued.

Name of stone.	No. of test.	Compressive strength per square inch.	Transverse strength, modulus of rupture per square inch.	Shearing strength per square inch.	Weight per cubic foot.	Compressive modulus of elasticity per square inch.	Ratio of lateral expansion to longitudinal compression.	Coefficient of expansion in water.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		*Inch.*
Sutherland Falls marble from Vermont	7462	16,506						
	7463	15,806						
	1316					12,580,000	4 1/2	
	418		3,054					
	452		1,531					.00000550
	278			2,010				
	279			1,119				
Fossiliferous marble from St. Joe, Searcy County, Ark	7465	10,130						
	7466	10,393						
	7467	10,413						
	1319					8,210,000	3 1/2	
	421		1,615					
	454		567					.00000219
Chocolate marble from St. Joe, Searcy County, Ark	7468	12,494						
	7469	13,762						
	7470	10,577						
	1320					10,740,000	3 1/2	
	422		1,693					
	423		1,534					
Richville white marble from Dekalb, St. Lawrence County, N. Y.	7181	13,733						
	7182	10,478						
	7183	12,004						
	7464	13,772						
	1317					12,000,000	4 1/4	
	420		1,144					
	453		533					.00000634
Marble from Marble Hill, Ga.	1354				167.7	4,480,000	12 1/2	
	1355				167.8	6,550,000	8 1/2	
	465		604					.00000202
	466		1,471					.00000185
Marble from Tate, Ga. — Creole quarry	1357				169	4,060,000	8 1/2	
	468		828					
Cherokee quarry	1358				168.4	3,980,000	8 1/2	
	469		882					
Etowah quarry	456		1,780					.00000441
Kennesaw quarry	455		1,317					

Limestone, from Isle LaMotte, Vt		7495	13,662					
		7496	15,581					
		1331					14,720,000	$\frac{1}{3}$
		403		2,493				
		438		786				.00000219
		298			1,946			
		299			2,400			
Limestone, from Wasioja, Dodge County, Minn	Buff color	7481	4,029					
		316			1,084			
	Gray color	7482	5,014					
		448		253				.00000217
		315			1,186			
Limestone, from Junction City, Kans		7700	2,996					
		7701	3,350					
		450		528				.00000300
Limestone, from Fort Riley, Kans		313			1,120			
		314			958			
		471			988			
Limestone from Beaver, Carroll County, Ark		7489	20,281					
		7490	21,397					
		7491	20,064					
		1327					6,580,000	$\frac{1}{6}$
		1328					6,760,000	$\frac{1}{4}$
		405		3,023				
		406		2,705				
		404		2,853				
		441		2,247				.00000471
		282			1,641			
		283			2,119			
		284			2,179			
		285			2,053			
Limestone from Mount Vernon, Ky		1343					4,000,000	$\frac{1}{3}$
		412		1,196				
		413		1,673				
		447		1,076				.00000464
Limestone from Rockwood, Ala		7471	5,752					
		7472	6,162					
		446		690				.00000058
		265			978			
Limestone from Bowling Green, Ky		7473	6,008					
		7474	6,077					
		1321					9,290,000	$\frac{1}{8}$
		410		1,317				
		445		799				.00000089
		266			1,257			
		267			1,164			

Observations made $\frac{3}{4}''$ from end A.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
989	100	0.	0.	Initial load.
39,560	4,000	.0032	.....	
989	100	.....	0.	
39,560	4,000	.0033	.....	
989	100	.....	.0001	

BRICK FROM GLADDING, MCBEAN & CO., SAN FRANCISCO, CAL.

No. 1380.

Front pressed brick. Stiff mud machine. Hard burnt. Dark buff color.
Length, 8″.29.
Sectional area, 2″.28×4″.04=9.21 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
921	100	0.	0.	Initial load.
1,842	200	.0001	.....	
2,763	300	.0002	.....	
3,684	400	.0003	.....	
4,605	500	.0004	.....	
5,526	600	.0005	.....	
6,447	700	.0006	.....	
7,368	800	.0007	.....	
8,289	900	.0008	.....	
9,210	1,000	.0009	0.	
13,815	1,500	.0014	.....	
18,420	2,000	.0020	.....	
23,025	2,500	.0026	.....	
27,630	3,000	.0032	.0001	
32,235	3,500	.0038	.....	
36,840	4,000	.0043	.....	
41,445	4,500	.0050	.....	
46,050	5,000	.0056	.....	
36,840	4,000	.0046	.....	
27,630	3,000	.0035	.....	
18,420	2,000	.0023	.....	
9,210	1,000	.0011	.....	
921	100	.....	.0002	
9,210	1,000	.0011	.....	
18,420	2,000	.0022	.....	
27,630	3,000	.0034	.....	
36,840	4,000	.0045	.....	
46,050	5,000	.0057	.....	
36,840	4,000	.0046	.....	
27,630	3,000	.0036	.....	E=4,450,000 per square inch.
18,420	2,000	.0024	.....	
9,210	1,000	.0012	.....	
921	100	.....	.0002	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5 at middle of length of brick.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
921	100	0.	0.	Initial load.
46,050	5,000	.0008	.....	
921	100	.....	0.	
46,050	5,000	.0008	.....	
921	100	.....	.0001	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{4.8}$.
Observations made 1½″ from end B.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
921	100	0.	0.	Initial load.
46,050	5,000	.0005	.....	
921	100	.....	0.	
46,050	5,000	.0006	.....	
921	100	.....	.0001	

Observations made 1½″ from end A.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
921	100	0.	0.	Initial load.
46,050	5,000	.0006	.....	
921	100	.....	0.	
46,050	5,000	.0006	.....	
921	100	.....	0.	

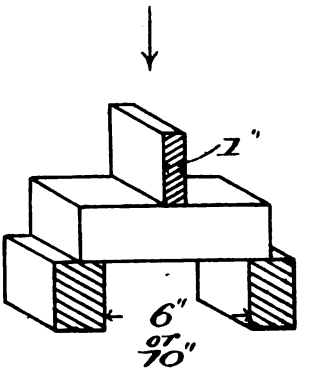
Tabulation of results of compression, transverse, and shearing tests, and coefficients of expansion in water—Continued.

Name of stone.	No. of test.	Compressive strength per square inch.	Transverse strength, modulus of rupture per square inch.	Shearing strength per square inch.	Weight per cubic foot.	Compressive modulus of elasticity per square inch.	Ratio of lateral expansion to longitudinal compression.	Coefficient of expansion in water.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		*Inch.*
Sandstone from Tenino, Wash.	7418	6,691						
	7419	6,567						
	7420	6,806						
	1325					1,020,000	$\frac{1}{12}$	
	401		667					
	435		323					.00000847
	289			1,063				
	290			1,389				
Sandstone from Pittsburg, Wash	7823	19,208						
Dyckerhoff's neat cement	1359					2,620,000	$\frac{1}{17}$	
	1360					2,200,000	$\frac{1}{13}$	
Plaster of paris	1361	795						
	1362					920,000	$\frac{1}{8}$	

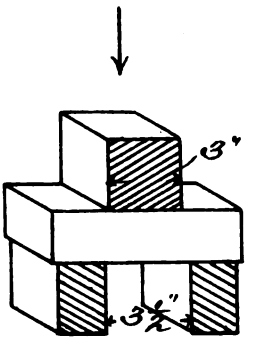
BRICKS, TILES, AND BUILDING BLOCKS.

ABSORPTION OF WATER AND COMPRESSION TESTS.

Tests of Bricks.



Transverse tests.



Shearing tests.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

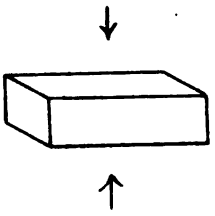
ABSORPTION OF WATER—Continued.

Compression test number.	Contributor.	Weight, dry.		Absorption of water.			
				Total.		By weight.	By volume.
		Lbs.	*Ounces.*	*Lbs.*	*Ounces.*	*Per ct.*	*Per ct.*
7603	Blanford Brick and Tile Co	5	7½	.....	3½	3.7	7.6
7604	.....do	5	1½	.....	3½	4.3	9.2
7605	.....do	7	10½	.....	13½	11.0	20.3
7606	Sayre and Fisher Co	5	4½	.....	8½	12.8	19.3
7607	.....do	5	½	.....	10½	13.0	24.4
7608	.....do	5	5½	.....	6	6.9	12.9
7609	.....do	5	1½	.....	8½	10.4	18.8
7610	M. D. Hunton	5	12½	.....	2½	2.7	6.2
7611	.....do	5	6	.....	1½	1.7	4.1
7612	.....do	5	6½	.....	6	6.9	15.1
7622	Powhatan Clay Manufacturing Co	5	½	.....	8½	10.9	20.7
7623	.....do	5	½	.....	9½	11.8	22.0
7624	.....do	4	9½	.....	4½	6.1	13.6
7625	.....do	4	11½	.....	4½	6.0	13.1
7626	.....do	4	9½	.....	4½	6.1	13.3
7627	.....do	4	7½	.....	8½	12.2	24.3
7628	.....do	4	7½	.....	6	8.4	17.6
7629	.....do	4	6½	.....	6½	8.8	18.6
7633	John Eharker	6	13½	.....	13½	12.5	21.1
7636	.....do	6	4½	.....	13½	13.1	21.3
7639	Gay Head Clay and Brick Co	5	7½	.....	5½	6.3	12.3
7642	.....do	5	9	.....	6½	7.0	13.6
7702	.....do	6	10½	.....	15½	14.3	25.0
7704	.....do	7	2½	1	½	14.2	24.6
7706	New Hampshire Moulded Granite Co	6	4½	.....	4	4.	8.1
7709	New England Steam Brick Co	5	10½	.....	11½	13.0	24.0
7649	.....do	5	7	.....	10½	12.4	23.5
7652	.....do	5	10	.....	5½	6.4	13.3
7655	.....do	5	13	.....	8½	9.1	17.9
7658	.....do	6	½	.....	4½	4.4	9.4
7661	.....do	5	13	.....	2½	2.4	5.6
7662	.....do	5	8	.....	11½	12.8	24.6
7663	.....do	4	13	.....	14½	19.1	32.2
7667	.....do	5	9	.....	13½	15.2	27.3
7677	.....do	5	12½	.....	11½	12.7	23.7
7680	.....do	5	3½	.....	6½	7.8	15.4
7671	.....do	5	8½	.....	1½	1.7	3.9
7674	.....do	5	9½	.....	1	1.1	2.6
a 338	.....do	5	1½	.....	12	14.7	25.8
7685	Pacific Clay Manufacturing Co	5	6½	.....	12½	14.2	26.2
7686	.....do	5	10½	.....	13½	14.9	27.6
7688	Grant Brick Co	6	15½	.....	1½	1.1	2.5
7689	.....do	7	2½	.....	1½	1.5	3.6
7690	.....do	6	15½	.....	1½	1.6	3.6
7693	Muscatine Terra Cotta Lumber Co	5	4½	.....	1½	1.5	3.2
7694	.....do	5	7½	.....	1½	1.4	3.1
7695	.....do	5	7	.....	1½	1.4	3.1
		Grammes.		*Grammes.*			
7711	American Encaustic Tiling Co	144.1		8.5		5.9	12.8
7712	.....do	141.1		4.0		2.8	6.4
7713	.....do	147.9		4.6		3.1	7.0
7714	.....do	151.3		3.2		2.1	4.9
7715	.....do	163.6		5.2		3.2	7.4
7716	.....do	153.4		3.3		2.1	5.0
7717	.....do	134.7		13.3		9.9	19.9
7718	.....do	167.0		0.1		0.06	0.14
7719	.....do	160.8		0.		0.	0.
7720	.....do	168.0		0.1		0.06	0.14
7721	.....do	173.5		0.		0.	0.
7722	.....do	171.3		0.2		0.12	0.27
7723	.....do	170.0		0.4		0.23	0.56
7724	.....do	164.7		0.2		0.12	0.29
7725	.....do	798.5		0.3		0.04	0.09
7726	.....do	792.6		0.4		0.05	0.12
7727	.....do	814.2		0.5		0.06	0.14
7728	.....do	194.1		27.7		14.2	26.8
7729	.....do	202.4		25.0		12.3	23.9

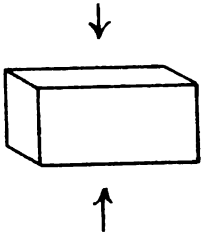
a Transverse test.

Tests of Bricks.

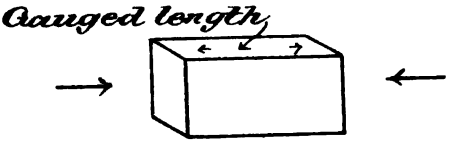
Compression tests.



Flatwise.



Edgewise



Compressive Elastic Properties.

THE HORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

Bricks from the New England Steam Brick Company, Providence, R. I.

[Works at Barrington and Nayatt, R. I.]

LIGHT RED BRICK NO. 0.

No. of test.	Distance between end supports	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
327	6.00	4.11	2.48	1,008	359	

RED SMOOTH CUT BRICK NO. 1.

328	6.00	4.02	2.41	2,947	1,153	

RED SMOOTH-CUT BRICK NO. 2.

329	6.00	3.97	2.45	3,042	1,149	

RED SMOOTH-CUT BRICK NO. 3.

330	6.00	3.93	2.34	2,925	1,223	

RED SMOOTH-CUT BRICK NO. 4.

331	6.00	3.99	2.37	2,102	844	

RED SMOOTH-CUT BRICK NO. 5.

332	6.00	3.82	2.34	3,615	1,555	
333	6.00	3.85	2.37	3,730	1,552	

DARK BUFF FRONT BRICK NO. 51.

334	6.00	4.20	2.34	1,496	585	

LIGHT BUFF FRONT BRICK NO. 55.

335	6.00	4.01	2.37	1,798	718	

"63 PRESS" LIGHT CHOCOLATE-COLORED BRICK.

336	6.00	4.17	2.41	895	332	

LIGHT HARD WATER-STRUCK BRICK FROM YARD NO. 1.

337	6.00	4.06	2.47	3,042	1,105	

LIGHT HARD SAND-STRUCK BRICK FROM YARD NO. 2, USED FOR FILLING OR INSIDE PURPOSES.

338	6.00	3.84	2.52	1,914	706	

BRICKS FROM THE BAY STATE BRICK COMPANY, BOSTON, MASS.

Made on special brick machines from clay procured in vicinity of Boston.

Hard-burnt red brick, used for building, paving, sewers, etc.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7520	3.38	2.14	7.71	16.50	37,000	246,100	14,915	Tested on edge.
7521	2.14	3.36	7.85	26.38	38,000	453,200	17,180	
7522	3.38	2.12	7.64	16.20	26,000	279,500	17,253	Do.
7523	2.14	3.36	7.71	25.91	47,000	381,600	14,728	

Compression test of half brick after tests by transverse loads.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7761	346	2.20	3.40	4.04	13.74	21,000	154,900	11,274	

PAVING BRICKS FROM SOMERSET AND JOHNSONBURG MANUFACTURING COMPANY, BOSTON, MASS.

[Factories at Somerset, Mass., and Johnsonburg, Pa.]

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7317	.....	3.92	2.41	8.45	20.36	67,000	151,900	7,412	Tested on edge.
7318	.....	2.34	3.99	8.37	33.40	68,000	458,200	13,719	Do.
7319	.....	4.23	2.58	8.83	22.78	39,000	274,100	12,032	Do.
7320	.....	4.01	2.37	8.36	19.81	48,000	252,100	12,726	Do.
7321	5	4.02	2.48	8.39	20.81	42,000	264,600	12,715	Do.

Bricks from the Gay Head Clay and Brick Company, Chelsea, Mass.

BUFF-COLORED BRICKS.

No. of test.	Dimensions. Height.	Compressed surface.		Sectional area.	First crack.	Ultimate strength. Total.	Per square inch.	Remarks.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7637	2.32	4.14	8.20	33.95	108,000	217,200	6,398	
7638	2.38	4.15	8.27	34.32	105,000	206,500	6,017	
7639	2.30	4.10	8.16	33.46	68,000	216,000	6,455	
7640	4.10	2.25	8.13	18.29	108,000	131,700	7,201	Tested on edge.
7641	4.15	2.30	8.26	19.00	53,000	133,600	7,032	Do.
7642	4.17	2.30	8.27	19.02	109,000	135,800	7,140	Do.

DARK BUFF SPECKLED BRICKS.

7643	1.57	4.06	11.96	48.56	188,000	499,200	10,280	
7644	1.58	4.05	11.81	47.83	285,000	529,600	11,072	
7645	4.20	1.54	12.04	18.54	54,000	98,600	5,318	Tested on edge.
7646	4.08	1.54	11.97	18.43	89,000	105,400	5,711	Do.

FIRE BRICKS, BRANDED "SALAMANDER XX."

7647	2.52	4.70	9.40	44.18	74,000	124,800	2,824	
7702	2.48	4.60	9.25	42.55	71,000	119,100	2,799	
7703	4.58	2.42	9.20	22.26	49,000	49,100	2,206	Tested on edge.
7704	4.69	2.58	9.44	24.35	55,000	56,300	2,312	Do.

Compression tests of half bricks after test by transverse loads.

BUFF COLORED.

No. of test.	Transverse test number.	Dimensions. Height.	Compressed surface.		Sectional area.	First crack.	Ultimate strength. Total.	Per square inch.	Remarks.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7732	317	2.39	4.08	4.72	19.26	79,000	111,200	5,774	
7786	317	2.39	4.08	2.96	12.08	36,000	59,200	4,900	Tested wet.
7733	318	2.32	4.04	4.28	17.29	72,000	96,300	5,570	
7787	318	2.32	4.04	3.61	14.58	21,000	77,950	5,346	Do.
7734	319	4.12	2.30	4.35	10.00	74,200	74,200	7,420	Tested on edge.
7735	320	4.14	2.30	4.30	9.89	56,000	66,300	6,704	Do.

BUFF SPECKLED.

7738	323	1.57	4.02	6.34	25.49	143,000	276,500	10,847	
7739	324	1.55	4.03	5.45	21.96	117,000	208,400	9,490	
7740	325	4.01	1.52	6.16	9.36	58,500	69,500	7,425	Tested on edge.
7741	326	4.10	1.58	5.92	9.35	60,600	60,600	6,481	Do.
7790	326	4.10	1.58	3.99	6.30	31,900	31,900	5,063	Tested wet on edge.

FIRE BRICKS.

7736	321	2.51	4.73	4.80	22.70	59,000	59,900	2,639	
7788	321	2.51	4.73	4.30	20.34	39,000	47,200	2,321	Tested wet.
7737	322	2.53	4.72	4.67	22.04	42,000	51,700	2,346	
7789	322	2.53	4.72	4.12	19.45	29,500	41,200	2,118	Do.

BRICKS FROM BLANDFORD BRICK AND TILE COMPANY, RUSSELL, MASS.

BUILDING BRICKS.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7601	No. 27	2.18	3.99	8.15	32.52	161,000	239,900	7,377	Buff color.
7602	K	2.18	3.96	8.13	32.19	128,000	306,050	9,507	Gray color.
7603	K	2.28	4.02	8.19	32.92	120,000	199,800	6,069	Dark color. Has sunken panels ".10 deep.

DARK BROWN PAVING BRICK.

7604	A	3.93	2.21	8.17	17.41	51,000	114,200	6,559	Tested on edge.

BUFF FIRE BRICK.

7605	.....	2.57	4.78	9.47	45.27	76,000	108,300	2,392	

Compression tests of half brick after test by transverse loads.

BUILDING BRICK, BUFF COLOR.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7765	350	2.21	4.00	4.55	18.20	102,000	103,500	5,687	

Bricks from the Monticello Brick Works, Located at Monticello, Minn.

RED FACE BRICK NO. 2.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
351	6.00	4.10	2.19	1,497	685	

Brick from the Kelley Brick and Tile Company, Minneapolis, Minn.

LIGHT STRAW COLOR.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
365	6.00	3.69	2.33	3,544	1,592	

Fire Brick from the Pacific Clay Manufacturing Company, Los Angeles, Cal.

[Works at South Riverside, Cal.]

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
363	6.00	4.17	2.40	2,384	893	

Molded Granite from the New Hampshire Molded Granite Company, Keene, N. H.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
362	6.00	4.06	2.35	3,825	1,536	

BRICKS.

SHEARING TESTS.

BRICKS.

Brick from the Bay State Brick Company, Boston, Mass.

HARD-BURNT RED BRICK, USED FOR BUILDING, PAVING, SEWERS, ETC.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
346	6.00	3.40	2.20	2,634	1,440	

Bricks from the Gay Head Clay and Brick Company, Chelsea, Mass.

BUFF-COLORED BRICKS.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
317	6.00	4.08	2.39	2,380	919	
318	6.00	4.04	2.32	1,098	827	
319	6.00	2.30	4.12	4,174	962	Tested on edge.
320	6.00	2.30	4.14	4,198	958	Do.

FIRE BRICKS.

321	6.00	4.73	2.51	1,108	334	
322	6.00	4.72	2.53	1,052	313	

BUFF-SPECKLED BRICKS, 12″.

323	10.00	4.02	1.57	882	1,337	
324	10.00	4.03	1.55	649	1,007	
325	10.00	1.52	4.01	2,514	1,543	Tested on edge.
326	10.00	1.58	4.10	2,249	1,270	Do.

Brick from Blandford Brick and Tile Company, Russell, Mass.

BUILDING BRICK, LIGHT GRAY COLOR.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
350	6.00	4.00	2.21	1,368	631	

BRICKS FROM THE NEW ENGLAND STEAM BRICK COMPANY, PROVIDENCE, R. I.

[Works at Barrington and Nayatt, R. I.]

LIGHT RED BRICK NO. 0.

No. of test.	Distance between end supports	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
327	6.00	4.11	2.48	1,008	359	

RED SMOOTH CUT BRICK NO. 1.

328	6.00	4.02	2.41	2,947	1,153	

RED SMOOTH-CUT BRICK NO. 2.

329	6.00	3.97	2.45	3,042	1,149	

RED SMOOTH-CUT BRICK NO. 3.

330	6.00	3.93	2.34	2,925	1,223	

RED SMOOTH-CUT BRICK NO. 4.

331	6.00	3.99	2.37	2,102	844	

RED SMOOTH-CUT BRICK NO. 5.

332	6.00	3.82	2.34	3,615	1,555	
333	6.00	3.85	2.37	3,730	1,552	

DARK BUFF FRONT BRICK NO. 51.

334	6.00	4.20	2.34	1,496	585	

LIGHT BUFF FRONT BRICK NO. 55.

335	6.00	4.01	2.37	1,798	718	

"63 PRESS" LIGHT CHOCOLATE-COLORED BRICK.

336	6.00	4.17	2.41	895	332	

LIGHT HARD WATER-STRUCK BRICK FROM YARD NO. 1.

337	6.00	4.06	2.47	3,042	1,105	

LIGHT HARD SAND-STRUCK BRICK FROM YARD NO. 2, USED FOR FILLING OR INSIDE PURPOSES.

338	6.00	3.84	2.52	1,914	706	

Bricks from the New England Steam Brick Company, Povidence, R. I.—Continued.

[Works at Barrington and Nayatt, R. I.]

HARD BODY BRICK FROM YARD NO. 2.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
339	6.00	3.68	2.42	3,386	1,414	

SMOOTH-CUT PAVING BRICK.

340	6.00	3.68	2.35	4,595	2,233	

PAVING BRICK.

341	6.00	3.75	2.36	3,790	1,633	
342	6.00	3.72	2.39	3,398	1,440	

Bricks from the Sayre & Fisher Company, Sayreville, N. J.

LIGHT CHOCOLATE COLOR, NO. 71.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
352	6.00	3.96	2.28	2,405	1,051	

BUFF SPECKLED, No. 27.

353	10.00	4.04	1.53	829	1,315	12″ brick.

BUFF SPECKLED, No. 33.

354	10.00	4.00	1.50	1,106	1,843	12″ brick.

Paving Brick from Grant Brick Company, Franklin, Pa.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
366	6.00	4.09	2.41	6,835	2,589	

Bricks from the Powhatan Clay Manufacturing Company, Richmond, Va.

CREAM-WHITE BRICK NO. 1.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds*	*Pounds.*	
355	6.00	3.85	2.31	1,180	825	

DARK RED BRICK NO. 2.

356	6.00	3.59	2.18	2,795	1,475	

LIGHT RED BRICK NO. 3.

357	6.00	3.58	2.11	3,349	1,892	

CREAM-WHITE BRICK NO. 4.

358	10.00	3.80	2.40	1,658	1,136	12″ brick.
350	10.00	2.38	3.80	2,348	1,025	12″ brick, tested on edge.

Bricks from the Brooke Terra Cotta Company, Lazearville, W. Va.

MEDIUM DARK BUFF, NO. 5.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
364	6.00	4.15	2.44	4,205	1,533	

Bricks from the Coaldale Brick and Tile Company, Coaldale, Jefferson County, Ala.

DARK-RED VITRIFIED PAVING BRICK A.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
360	6.00	2.92	3.63	9,298	2,174	Tested on edge.

DARK-RED VITRIFIED PAVING BRICK C.

361	6.00	2.89	3.61	6,566	1,569	Tested on edge.

Fire Brick from John Eharker, Ashby, Ala.

NO. 1 BRICK FOR HOT BLAST, ETC.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
343	*Inches.* 6.00	*Inches.* 4.26	*Inches.* 2.54	*Pounds.* 1,020	*Pounds.* 334	

Paving Brick and Block from the A. O. Jones Brick and Terra Cotta Company, Zanesville, Ohio.

VITRIFIED PAVING BRICK.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
348	*Inches.* 6.00	*Inches.* 2.57	*Inches.* 3.93	*Pounds.* 8,224	*Pounds.* 1,865	Tested on edge.

VITRIFIED PAVING BLOCK.

349	6.00	3.05	4.02	7,540	1,377	Tested on edge.

Bricks from the Kansas City Hydraulic Press Brick Company, Kansas City, Mo.

RED BUILDING BRICK NO. 1.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
344	*Inches.* 6.00	*Inches.* 3.98	*Inches.* 2.33	*Pounds.* 2,074	*Pounds.* 864	

RED BUILDING BRICK NO. 2.

345	6.00	4.14	2.32	2,946	1,190	

Vitrified Paving Brick from the Capital City Vitrified Brick and Paving Company, Topeka, Kans.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
347	*Inches.* 6.00	*Inches.* 2.30	*Inches.* 3.79	*Pounds.* 7,568	*Pounds.* 2,062	Tested on edge.

BRICKS FROM THE COALDALE BRICK AND TILE COMPANY, COALDALE, JEFFERSON COUNTY, ALA.

BUFF-COLORED PRESS BRICK.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7557	2.38	4.18	8.48	35.45	278,000	426,500	12,031	
7558	2.34	4.20	8.47	35.57	308,000	527,100	14,818	
7559	2.40	4.20	8.51	35.74	348,000	453,900	12,700	

RED-COLORED PRESS BRICK.

7560	2.39	4.00	8.32	33.28	97,900	125,300	3,765	
7561	2.42	3.96	8.30	32.87	93,000	93,100	2,832	
7562	2.30	4.55	8.25	37.54	139,000	147,600	3,932	

PAVING BRICKS.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7563	A	3.54	2.90	8.51	24.68	47,000	261,200	10,583	Tested on edge.
7564	A	3.53	2.94	8.53	25.08	28,000	212,800	8,485	Do.
7565	B	3.45	2.89	8.32	24.04	37,000	149,200	6,206	Do.
7566	B	3.45	2.83	8.22	23.26	39,000	178,100	7,657	Do.
7567	C	3.43	2.85	8.19	23.34	51,000	201,100	8,616	Do.
7568	C	3.45	2.90	8.54	24.77	63,000	200,500	9,034	Do.

Compression tests of half bricks after test by transverse loads.

VITRIFIED PAVING BRICK, A.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7778	360	3.63	2.92	3.70	10.80	21,000	171,100	15,842	Tested on edge.
7815	360	3.63	2.92	4.25	12.41	27,000	139,900	11,273	Tested wet on edge.

VITRIFIED PAVING BRICK, C.

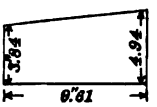
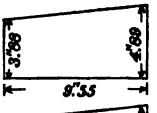
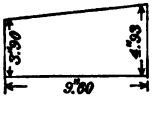
7779	361	3.61	2.89	4.03	11.65	63,000	81,500	6,996	Tested on edge.

FIRE BRICKS FROM JOHN EHARKER, ASHBY, ALA.

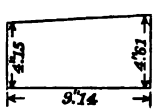
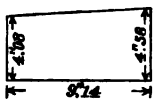
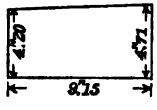
ARCH BRICK FOR COKE OVENS.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7630	No. 2	5.35	4.43	9.13	40.45	99,000	104,800	2,591	2 bricks tested together.

BULLHEAD BRICKS FOR LIMEKILNS, ETC.

7631	No. 3	2.55		42.19	117,000	140,500	3,330	
7632	No. 3	2.50		41.88	86,000	114,900	2,744	
7633	No. 3	2.65		42.38	88,000	129,800	3,063	

RIM BRICKS FOR COKE OVENS.

7634	No. 4	2.60		40.03	124,000	148,400	3,707	
7635	No. 4	2.60		39.58	91,000	152,100	3,843	
7636	No. 4	2.63		40.76	123,000	151,100	3,707	

Compression tests of half bricks after test by transverse loads.

FIRE BRICK NO. 1.

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7758	343	2.54	4.26	4.58	19.51	42,000	47,100	2,414	
7804	343	2.54	4.26	3.91	16.66	28,000	31,400	1,885	Tested wet.

Building Brick from the Superior Brick Company, Rockford, Ill.

HARD BURNT.

No. of test.	Marks.	Dimensions. Height.	Compressed surface		Sectional area.	First crack.	Ultimate strength. Total.	Per square inch.	Remarks.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7569	No. 1	2.14	3.44	7.81	26.87	134,000	181,200	6,743	
7570	No. 1	2.15	3.49	7.95	27.75	164,800	164,800	5,939	
7571	No. 1	2.18	3.50	7.97	27.89	163,000	168,200	6,031	

MEDIUM HARD BURNT.

7572	No. 2	2.21	3.65	8.17	29.82	92,350	92,350	3,097	
7573	No. 2	2.28	3.63	8.22	29.84	53,800	53,800	1,803	
7574	No. 2	2.27	3.65	8.17	29.82	50,500	50,500	1,693	

SOFT BURNT.

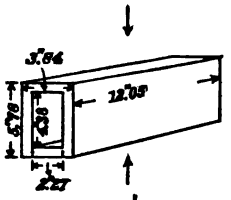
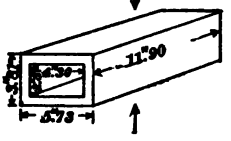
7575	No. 3	2.28	3.70	8.29	30.67	29,400	29,400	958	
7576	No. 3	2.28	3.70	8.25	30.52	34,900	34,900	1,143	
7577	No. 3	2.30	3.72	8.30	30.88	29,850	29,850	966	

Paving Bricks and Hollow Building Blocks from Muscatine Terra Cotta Lumber Company, Muscatine, Iowa.

PAVING BRICKS.

No. of test.	Dimensions. Height.	Compressed surface.		Sectional area.	First crack.	Ultimate strength. Total.	Per square inch.	Remarks.
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7693	3.66	2.34	7.80	18.25	98,000	181,800	9,962	Tested on edge.
7694	3.82	2.34	7.73	18.09	102,000	216,100	11,946	Do.
7695	3.76	2.34	7.73	18.09	56,000	160,900	8,894	Do.
7696	2.38	3.65	7.78	28.40	49,000	325,200	11,451	
7697	2.40	3.63	7.88	28.60	32,000	284,800	9,958	

HOLLOW BUILDING BLOCKS.

7698		*Gross.* 46.27	.....	.....	2,038	
		Net. 18.92	55,000	94,300	4,984	
7699		*Gross.* 68.19	.....	.....	1,198	
		Net. 17.02	18,000	81,700	4,800	

BRICKS FROM THE NEW ENGLAND STEAM BRICK COMPANY, PROVIDNCE, R. I.—Continued.

[Works at Barrington and Nayatt, R. I.]

RED SMOOTH-CUT BRICK NO. 4.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
377	*Inches.* 2.39×4.01×2	*Sq. inch.* 19.17	*Pounds.* 5,100	*Pounds.* 31,020	*Pounds.* 1,618	One.

RED SMOOTH-CUT BRICK NO. 5.

378	2.39×3.80×2	18.16	6,900	33,040	1,819	One.

DARK BUFF FRONT BRICK NO. 51.

379	2.40×4.20×2	20.16	4,700	19,450	964	One.

LIGHT BUFF FRONT BRICK NO. 55.

380	2.40×4.03×2	19.34	4,300	19,120	989	Two.

LIGHT HARD WATER-STRUCK BRICK FROM YARD NO. 1.

381	2.54×4.09×2	20.78	9,900	21,300	1,025	One.

LIGHT HARD SAND-STRUCK BRICK FROM YARD NO. 2.

382	2.53×3.89×2	19.68	4,300	26,200	1,331	One.

HARD BODY BRICK FROM YARD NO. 2.

383	2.39×3.77×2	18.02	6,200	34,650	1,923	One.

SMOOTH-CUT PAVING BRICK.

384	2.36×3.70×2	17.46	7,300	27,260	1,561	One.

PAVING BRICK.

385	2.24×3.69×2	16.53	8,150	20,300	1,222	One.

PAVING BRICK FROM GRANT BRICK COMPANY, FRANKLIN, PA.

No. of test.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
				Total.	Per square inch.	
388	*Inches.* 2.44×3.94×2	*Sq. in.* 19.23	*Pounds.* 11,200	*Pounds.* 29,100	*Pounds.* 1,513	Two.

BRICKS FROM THE CLARK PRESSED BRICK COMPANY, MALVERN, ARK.

Bricks by the dry press process. The press used is the Boyd patent, made by Chisholm, Boyd & White, Chicago, Ill.

BUILDING BRICK, CHOCOLATE COLOR.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
	Height.	Compressed surface.				Total.	Per square inch.	
	Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7540	2.41	4.06	8.44	34.27	382,000	508,800	14,847	
7541	2.39	4.09	8.42	34.44	306,000	459,200	13,333	

FIRE BRICK, DARK BUFF COLOR.

7542	2.30	4.03	8.19	33.01	538,000	665,400	20,157	
7543	2.30	4.10	8.10	33.21	475,000	716,800	21,584	
7544	2.29	4.09	8.16	33.37	554,000	707,500	21,202	

PAVING BRICKS.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7545	No. 1	4.10	2.30	8.09	18.61	144,000	251,800	13,530	Tested on edge.
7546	No. 1	4.05	2.32	8.14	18.88	55,000	227,500	12,050	Do.
7547	No. 1	4.07	2.28	8.09	18.45	128,000	232,000	12,574	Do.

PAVING BRICKS, HAND-MADE.

7548	No. 2	3.90	2.00	8.45	16.90	46,000	89,500	5,296	Tested on edge.
7549	No. 2	3.84	2.15	8.36	17.97	36,000	56,200	3,127	Do.
7550	No. 2	3.87	2.09	8.32	17.39	29,000	79,300	4,560	Do.

BRICKS, TILES, AND BUILDING BLOCKS.

TABULATION OF RESULTS OF COMPRESSION, TRANSVERSE, AND SHEARING TESTS AND ABSORPTION OF WATER.

BUILDING BRICKS AND TILES.

Contributor.	Description.	Marks.	No. of test.	Compressive strength per square inch.	Transverse strength, modulus of rupture per square inch.	Shearing strength per square inch.	Compressive modulus of elasticity per square inch.	Ratio of lateral expansion to longitudinal compression.	Absorption of water— By weight.	Absorption of water— By volume.	Remarks.
				Pounds.	*Pounds.*	*Pounds.*	*Pounds.*		*Per ct.*	*Per ct.*	
Bay State Brick Co., Boston, Mass.	Hard burnt, for building, paving, sewers, etc.		7520	14,915					8.4	7.7	Tested on edge.
			7521	17,180							
			7522	17,253					8.1	7.1	Do.
			7523	14,728							
			7761	11,274							Half brick.
			346		1,440						
Philadelphia and Boston Face Brick Co., Boston, Mass.	Soft burnt, for inside work, salmon color.		1381				891,000	$\frac{1}{7}$			
			1382				517,000	$\frac{1}{5.7}$			
Do	Dark red, for outside work		1383				2,190,000 to 2,520,000	$\frac{1}{5}$			
Do	Cream color, for outside work.		1384				577,000	$\frac{1}{5}$			
Do	Buff color, for outside work		1385				2,570,000	$\frac{1}{5}$			
Do	Chocolate brown, for outside work.		1386				5,000,000	$\frac{1}{4}$			
			7637	6,398							
			7638	6,017							
			7639	6,455					6.3	12.3	
			7640	7,201							Tested on edge.
			7641	7,032							Do.
			7642	7,140					7.0	13.6	Do.
Gay Head Clay and Brick Co., Chelsea, Mass.	Buff colored		317		919						
			318		827						
			319		962						Do.
			320		958						Do.
			367			846					
			368			846					
			369			1,426					Do.
			370			1,817					Do.

			7643	10,280							
			7644	11,072							Do.
			7645	5,318							Do.
			7646	5,711							
Do	Buff speckled		323		1,337						
			324		1,007						
			325		1,543						Do.
			326		1,270						Do.
Blandford Brick and Tile Co., Russell, Mass.	Buff color	No. 27	7601	7,377							
Do	Gray color	K	7602	9,507							
Do	Dark color; has sunken panels.	K	7603	6,069						8.7	7.6
Do	Light gray		350		631						
New England Steam Brick Co., Providence, R. I.	Light red	No. 0	7707	6,085							
Do	do	No. 0	7708	7,546							
Do	do	No. 0	7709	6,061						13.0	24.0
Do	do	No. 0	327		359						
Do	do	No. 0	373			1,445					
Do	Red, smooth-cut	No. 1	7710	6,588							
Do	do	No. 1	7648	6,906							
Do	do	No. 1	7649	5,783						12.4	23.5
Do	do	No. 1	328		1,153						
Do	do	No. 1	374			1,335					
Do	do	No. 2	7650	10,590							
Do	do	No. 2	7651	8,730							
Do	do	No. 2	7652	10,137						6.4	13.3
Do	do	No. 2	329		1,149						
Do	do	No. 2	375			1,476					
Do	do	No. 3	7653	12,456							
Do	do	No. 3	7654	8,073							
Do	do	No. 3	7655	8,225						9.1	17.9
Do	do	No. 3	330		1,223						
Do	do	No. 3	376			1,567					
Do	do	No. 4	7656	11,075							
Do	do	No. 4	7657	8,939							
Do	do	No. 4	7658	11,153						4.4	9.4
Do	do	No. 4	331		844						
Do	do	No. 4	377			1,618					
Do	do	No. 5	7659	12,069							
Do	do	No. 5	7660	9,859							
Do	do	No. 5	7661	9,172						2.4	5.6
Do	do	No. 5	332		1,555						
Do	do	No. 5	333		1,552						
Do	do	No. 5	378			1,819					
Do	Dark buff front	No. 51	7662	4,294						12.8	24.6
Do	do	No. 51	334		585						
Do	do	No. 51	379			964					
Do	Smooth-cut buff	No. 51	7663	5,857						19.1	32.2
Do	do	No. 51	7664	4,463							
Do	Light buff front	No. 55	7681	3,234							

BRICKS, TILES, AND BUILDING BLOCKS.

TABULATION OF RESULTS OF COMPRESSION, TRANSVERSE, AND SHEARING TESTS AND ABSORPTION OF WATER.

BUILDING BRICKS AND TILES.

Contributor.	Description.	Marks.	No. of test.	Compressive strength per square inch.	Transverse strength, modulus of rupture per square inch.	Shearing strength per square inch.	Compressive modulus of elasticity per square inch.	Ratio of lateral expansion to longitudinal compression.	Absorption of water— By weight.	Absorption of water— By volume.	Remarks.
				Pounds.	*Pounds.*	*Pounds.*	*Pounds.*		*Per ct.*	*Per ct.*	
			7520	14,915					3.4	7.7	Tested on edge.
			7521	17,180							
Bay State Brick Co., Boston, Mass.	Hard burnt, for building, paving, sewers, etc.		7522	17,253					3.1	7.1	Do.
			7523	14,728							
			7761	11,274							Half brick.
			346		1,440						
Philadelphia and Boston Face Brick Co., Boston, Mass.	Soft burnt, for inside work, salmon color.		1381				391,000	$\frac{1}{7.5}$			
			1382				517,000	$\frac{1}{7.7}$			
Do	Dark red, for outside work		1383				2,190,000	$\frac{1}{8.9}$			
Do	Cream color, for outside work.		1384				2,520,000	$\frac{1}{8.9}$			
							577,000	$\frac{1}{7.5}$			
Do	Buff color, for outside work		1385				2,570,000	$\frac{1}{8.3}$			
Do	Chocolate brown, for outside work.		1386				5,000,000	$\frac{1}{8}$			
			7637	6,398							
			7638	6,017							
			7639	6,455					6.3	12.3	
			7640	7,201							Tested on edge.
			7641	7,032							Do.
			7642	7,140					7.0	13.6	Do.
Gay Head Clay and Brick Co., Chelsea, Mass.	Buff colored		317		919						
			318		827						
			319		962						Do.
			320		958						Do.
			367			846					
			368			846					
			369			1,426					Do.
			370			1,817					Do.

			7643	10,280							
			7644	11,072							Do.
			7645	5,318							Do.
			7646	5,711							
Do	Buff speckled		323		1,337						
			324		1,007						
			325		1,543						Do.
			326		1,270						Do.
Blandford Brick and Tile Co., Russell, Mass.	Buff color	No. 27	7601	7,377							
Do	Gray color	K	7602	9,507							
Do	Dark color; has sunken panels.	K	7603	6,069						3.7	7.6
Do	Light gray		350		631						
New England Steam Brick Co., Providence, R. I.	Light red	No. 0	7707	6,085							
Do	do	No. 0	7708	7,546							
Do	do	No. 0	7709	6,061						13.0	24.0
Do	do	No. 0	327		859						
Do	do	No. 0	378			1,445					
Do	Red, smooth-cut	No. 1	7710	6,588							
Do	do	No. 1	7648	6,906							
Do	do	No. 1	7649	5,783						12.4	23.5
Do	do	No. 1	328		1,153						
Do	do	No. 1	374			1,835					
Do	do	No. 2	7650	10,590							
Do	do	No. 2	7651	8,730							
Do	do	No. 2	7652	10,137						6.4	13.3
Do	do	No. 2	329		1,149						
Do	do	No. 2	375			1,476					
Do	do	No. 3	7653	12,456							
Do	do	No. 3	7654	8,073							
Do	do	No. 3	7655	8,225						9.1	17.9
Do	do	No. 3	330		1,223						
Do	do	No. 3	376			1,567					
Do	do	No. 4	7656	11,075							
Do	do	No. 4	7657	8,939							
Do	do	No. 4	7658	11,153						4.4	9.4
Do	do	No. 4	331		844						
Do	do	No. 4	377			1,618					
Do	do	No. 5	7659	12,069							
Do	do	No. 5	7660	9,859							
Do	do	No. 5	7661	9,172						2.4	5.6
Do	do	No. 5	332		1,555						
Do	do	No. 5	333		1,552						
Do	do	No. 5	378			1,819					
Do	Dark buff front	No. 51	7662	4,294						12.8	24.6
Do	do	No. 51	334		585						
Do	do	No. 51	379			964					
Do	Smooth-cut buff	No. 51	7663	5,857						19.1	32.2
Do	do	No. 51	7664	4,463							
Do	Light buff front	No. 55	7681	3,234							

Tabulation of results of compression, transverse, and shearing tests and absorption of water—Continued.

BUILDING BRICKS AND TILES—Continued.

Contributor.	Description.	Marks.	No. of test.	Compressive strength per square inch.	Transverse strength, modulus of rupture per square inch.	Shearing strength per square inch.	Compressive modulus of elasticity per square inch.	Ratio of lateral expansion to longitudinal compression.	Absorption of water—		Remarks.
									By weight.	By volume.	
				Pounds.	*Pounds.*	*Pounds.*	*Pounds.*		*Per ct.*	*Per ct.*	
New England Steam Brick Co., Providence, R. I.	Light buff front	No. 55	7682	3,579							
Do	do	No. 55	7683	3,106							
Do	do	No. 55	335		718						
Do	do	No. 55	390			989					
Do	Light chocolate		7665	6,633							
Do	do		7666	5,270							
Do	do	"63–Press"	7667	4,887					15.2	27.3	
Do	do	"63–Press"	336		332						
Do	Dark chocolate	"64"	7668	7,061							
Do	Light hard water-struck from yard No. 1.		7675	6,728							
			7676	5,116							
			7677	5,311					12.7	23.7	
			337		1,105						
			381			1,025					
Do	Light hard sand-struck from yard No. 2.		7285	9,113							
			7286	8,358							
			7287	5,762							
			338		706				14.7	25.8	
			382			1,331					
Do	Hard body from yard No. 2.		7678	11,311							
			7679	11,033							
			7680	11,129					7.8	15.4	
			339		1,414						
			383			1,923					
Eastern Hydraulic Press Brick Co., Philadelphia, Pa.	Shade 200		1365				2,120,000	$\frac{1}{3}$			
Do	Shade 300		1366				2,050,000	$\frac{1}{3}$			
Do	Shade 410		1367				2,170,000	$\frac{1}{3}$			Least burned.
Brush & Schmidt, Buffalo, N. Y.	Pressed brick	No. 1	7524	13,682							Medium hard.
Do	do	No. 2	7525	16,714							Hard burned.
Do	do	No. 3	7526	18,679							
Sayre & Fisher Co., Sayreville, N. J.	Salmon color	No. 8	7666	8,820					12.8	19.3	

Do	Cream color	No. 9	7607	9,890					13.0	24.4	
Do	Buff speckled	No. 13	7608	14,391					6.9	12.9	
Do	do	No. 14	7609	9,339					10.4	18.8	
Do	do	No. 27	353		1,315						12" brick.
Do	do	No. 33	354		1,843						Do.
Do	Light chocolate	No. 71	352		1,051						
National Brick and Tile Co., Bradford, Pa.	Red face brick, hard burnt	No. 1	7530	24,875							Not fractured.
		No. 1	7531	11,512					5.6	12.7	Tested on edge.
Do	Red face brick, soft burnt	No. 2	7532	7,017							
		No. 2	7533	7,394					10.3	20.6	
Washington Hydraulic-Press Brick Co., Washington, D. C.	Common red brick		7444	10,538							
			7445	7,619							
			7446	11,870							
Do	No. 10 press brick, for face work.		7447	10,967							
			7448	11,276							
			7449	10,882							
			7450	11,150							
Do	Arch brick, for foundations		7451	11,258							
			7452	9,683							
The Powhatan Clay Manufacturing Co., Richmond, Va.	Cream white	No. 1	7622	6,335					10.9	20.7	
Do	do	No. 1	7623	4,884					11.8	22.0	
Do	do	No. 1	1378				1,730,000	$\frac{1}{2}$			
Do	Dark red	No. 2	7624	14,060					6.1	13.6	
Do	do	No. 2	7625	12,364					6.0	13.1	
Do	do	No. 2	7626	9,100					6.1	13.3	
Do	do	No. 2	1377				3,180,000	$\frac{1}{3}$			
Do	do	No. 2	356		1,475						
Do	Light red	No. 3	7627	11,264					12.2	24.3	
Do	do	No. 3	7628	17,092					8.4	17.8	
Do	do	No. 3	7629	14,935					8.8	18.6	
Do	do	No. 3	357		1,892						
Do	do	No. 3	387			1,150					
Do	Cream white	No. 4	358		1,136						12" brick.
Do	do	No. 4	359		1,025						12" brick, tested on edge.
Brooke Terra Cotta Co., Lazearville, W. Va.	Columbian buff	No. 4	1375				4,060,000	$\frac{1}{3}$			
Do	Light buff		1376				4,820,000	$\frac{1}{2}$			
Do	Medium dark buff	No. 5	364		1,513						
Coaldale Brick and Tile Co., Coaldale, Ala.	Buff-colored press brick		7557	12,031							
			7558	14,818							
			7559	12,700					11.3	21.1	
Do	Red-colored press brick		7560	3,765							
			7561	2,832							
			7562	3,932					12.6	22.0	
Chicago Hydraulic Press Brick Co., Chicago, Ill.	Red brick		1368				1,410,000	$\frac{1}{2}$			
Do	Brown brick		1369	1,392			446,000				

Tabulation of results of compression, transverse, and shearing tests and absorption of water—Continued.

BUILDING BRICKS AND TILES—Continued.

Contributor.	Description.	Marks.	No. of test.	Compressive strength per square inch.	Transverse strength, modulus of rupture per square inch.	Shearing strength per square inch.	Compressive modulus of elasticity per square inch.	Ratio of lateral expansion to longitudinal compression.	Absorption of water—		Remarks.
									By weight.	By volume.	
				Pounds.	*Pounds.*	*Pounds.*	*Pounds.*		*Per ct.*	*Per ct.*	
Superior Brick Co., Rockford, Ill.	Hard burnt	No. 1	7569	6,743							
Do	do	No. 1	7570	5,939					20.1	32.7	
Do	do	No. 1	7571	6,031							
Do	Medium hard burnt	No. 2	7572	3,097							
Do	do	No. 2	7573	1,803					26.7	39.6	
Do	do	No. 2	7574	1,693							
Do	Soft burnt	No. 3	7575	958							
Do	do	No. 3	7576	1,143					29.1	42.2	
Do	do	No. 3	7577	966							
Kansas City Hydraulic Press Brick Co., Kansas City, Mo.	Red brick	No. 1	7584	11,221							
Do	do	No. 1	7585	12,667							
Do	do	No. 1	7586	11,895					13.1	24.9	
Do	do	No. 1	1373				1,650,000	$\frac{1}{5.5}$			
Do	do	No. 1	344		864						
Do	do	No. 2	7537	13,701							
Do	do	No. 2	7538	14,561							
Do	do	No. 2	7539	11,489					12.0	22.7	
Do	do	No. 2	1374				2,130,000	$\frac{1}{6.7}$			
Do	do	No. 2	345		1,100						
The Hydraulic Press Brick Co., St. Louis, Mo.	Medium red		1370				714,000	$\frac{1}{7.7}$			
Do	Light chocolate		1371				2,550,000	$\frac{1}{7.5}$			
Do	Dark buff speckled		1372				890,000	$\frac{1}{8.3}$			
Clark Press Brick Co., Malvern, Ark.	Chocolate		7540	14,847							
			7541	13,333					9.3	16.8	
			1363				1,520,000	$\frac{1}{4}$			
Noah Hamlet, Little Rock, Ark.	Soft burnt	No. 1	7578	2,028					10.6	32.7	
Do	Medium hard burnt	No. 2	7579	4,460							
Do	do	No. 2	7580	4,065					16.4	29.0	
Do	Hard burnt	No. 3	7581	5,988					14.9	26.0	
Do	White brick		7587	4,475							
Do	do		7588	3,820					16.9	28.4	

M. D. Hunton, Fort Smith, Ark.		Doyle No. 2	7612	6,588					6.9	15.1	
Monticello Brick Works, Monticello, Minn.	Face bricks	No. 2	7594	21,106							
Do	do	No. 2	7595	18,245					3.8	7.7	Tested on edge.
Do	do	No. 2	351		685						
Do	Soft face bricks	No. 3	7596	8,447							
			7597	7,543					12.0	23.4	
			7783	6,433							
Kelley Brick and Tile Co., Minneapolis, Minn.	Light straw color		7818	6,992							
			365		1,592						
Northern Hydraulic Press Brick Co., Minneapolis, Minn.			1364				1,040,000	½			
Gladding, McBean & Co., San Francisco, Cal.	Salmon, soft burnt		7505	10,367							
Do	do		7506	8,720							
Do	do		7507	9,144					11.1	21.9	
Do	do		1379				1,770,000 2,290,000	⅛			
Do	Buff, hard burnt		7508	4,864							
Do	do		7509	4,010							
Do	do		7510	3,949					11.3	21.6	
Do	Cream color, soft burnt		7511	7,140							
Do	do		7512	6,959							
Do	do		7513	7,698					13.3	24.0	
Do	Dark buff, hard burnt		7514	7,804							
Do	do		7515	8,422							
Do	do		7516	9,024					5.8	11.9	
Do	do		1380				4,450,000	⅛			
New Hampshire Molded Granite Co., Keene, N. H.	Molded granite		7705	12,584							
Do	do		7706	6,286					4.0	8.1	Ends outside sunken panel flaked off.
Do	do		362		1,536						
American Encaustic Tiling Co., Limited, New York, N. Y.	Unglazed tiles for floors, Nos. 1 to 14:										
	Buff color	No. 1	7711	22,775					5.9	12.8	
	Salmon	No. 2	7712	41,961					2.8	6.4	
	Light gray	No. 3	7713	48,764					3.1	7.0	
	Dark gray	No. 4	7714	35,623					2.1	4.9	
	Red	No. 5	7715	24,960					3.2	7.4	
	Chocolate	No. 6	7716	35,475					2.1	5.0	
	Black	No. 7	7717	17,729					9.9	19.9	
	Do	No. 7	7731	18,427							
	White	No. 8	7718	19,145					0.06	0.14	
	Do	No. 8	7730	46,866							
	Silver gray	No. 9	7719	33,660					0	0	
	Pink	No. 10	7720	29,881					0.06	0.14	
	Celadon	No. 11	7721	49,625					0	0	
	Light blue	No. 12	7722	17,615					0.12	0.27	

Tabulation of results of compression, transverse, and shearing tests and absorption of water—Continued.

BUILDING BRICKS AND TILES—Continued.

Contributor.	Description.	Marks.	No. of test.	Compressive strength per square inch.	Transverse strength, modulus of rupture per square inch.	Shearing strength per square inch.	Compressive modulus of elasticity per square inch.	Ratio of lateral expansion to longitudinal compression.	Absorption of water—		Remarks.
									By weight.	By volume.	
American Encaustic Tiling Co., Limited, New York, N. Y.—Continued.	Unglazed tiles for floors, Nos. 1 to 14—Continued.			*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		*Per ct.*	*Per ct.*	
	Dark blue	No. 13	7723	32,015					0.23	0.56	
	Green	No. 14	7724	20,307					0.12	0.29	
Do	Nos. 15, 16, and 17, unglazed, used for floors:										
	5000 G	No. 15	7725	49,770					0.04	0.09	
	5001 G	No. 16	7726	49,150					0.05	0.12	
	5006 G	No. 17	7727	61,264					0.06	0.14	
Do	Nos. 18 and 19, glazed tiles, used for walls and wainscoting:										
	White	No. 18	7728	8,897					14.2	26.8	
	Ivory	No. 19	7729	12,575					12.3	23.9	

FIRE BRICKS.

Gay Head Clay and Brick Co.	"Salamander XX"		7647	2,824							
Do	do		7702	2,799					14.8	25.0	
Do	do		7703	2,206							Tested on edge.
Do	do		7704	2,812					14.2	24.6	Do.
Do	do		321		334						
Do	do		322		313						
Do	do		371			417					
Do	do		372			418					
Do	do		7705	2,392					11.0	20.3	
Blandford Brick and Tile Co., Russell, Mass.	Buff		7630	2,591							Two bricks tested together.
John Eharker, Ashby, Ala.	Arch brick for coke ovens	No. 2	7631	3,330							
Do	Bullhead bricks for limekilns, etc.	No. 3	7632	2,744					12.5	21.1	
		No. 3	7633	3,068							

Do	Rim bricks for coke ovens	No. 4	7634	3,707							
		No. 4	7635	3,843							
		No. 4	7636	3,707					13.1	21.8	
Do	Brick for hot blast	No. 1	343		334						
		No. 1	386			355					
Clark Press Brick Co., Malvern, Ark.	Dark buff		7542	20,157							
Do	do		7543	21,584							
Do	do		7544	21,202							
Gladding, McBean & Co., San Francisco, Cal.	do		7517	4,418							
Do	do		7518	4,080							
Do	do		7519	4,274					10.4	19.5	
Pacific Clay Manufacturing Co., Los Angeles, Cal.			7684	3,954							
			7685	3,488					14.2	26.2	
			7686	4,148					14.9	27.6	
			7687	2,745							
			363		893						

PAVING BRICKS.

Somerset & Johnsonburg Manufacturing Co., Boston, Mass.			7317	7,412					2.68	5.95	Tested on edge.
			7318	13,719					2.76	6.08	
			7319	12,032					2.31	4.93	Do.
			7320	12,726					0.72	1.63	Do.
		5	7321	12,715					0.69	1.54	Do.
Blandford Brick and Tile Co., Russell, Mass.	Dark brown	A	7604	6,559					4.8	9.2	Do.
New England Steam Brick Co., Providence, R. I.	Smooth cut		7669	10,132							
Do	do		7670	7,863							
Do	do		7671	12,880					1.7	3.9	Do.
Do	do		340		2,233						
Do	do		384			1,561					
Do			7672	13,133							
			7673	15,158							
			7674	10,951					1.1	2.6	Do.
			341		1,633						
			342		1,440						
			385			1,222					
Brush & Schmidt, Buffalo, N. Y.	Light color		7527	10,104					3.5	8.0	Do.
Do	Medium hard		7528	10,147					4.5	10.0	Do.
Do	Dark, repressed, and vitrified		7529	19,086					1.28	0.67	Do.

Tabulation of results of compression, transverse, and shearing tests and absorption of water—Continued.

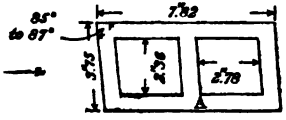
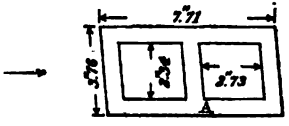
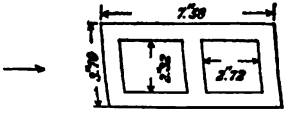
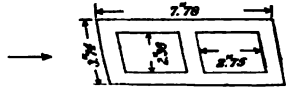
PAVING BRICKS—Continued.

Contributor.	Description.	Marks.	No. of test.	Compressive strength per square inch.	Transverse strength, modulus of rupture per square inch.	Shearing strength per square inch.	Compressive modulus of elasticity per square inch.	Ratio of lateral expansion to longitudinal compression.	Absorption of water—		Remarks.
									By weight.	By volume.	
				Pounds.	*Pounds.*	*Pounds.*	*Pounds.*		*Per ct.*	*Per ct.*	
Grant Brick Co., Franklin, Pa.			7688	18,697					1.1	2.5	
			7689	18,433					1.5	3.6	
			7690	18,302					1.6	3.6	
			7691	15,684							Half bricks from the same brick.
			7692	15,813							
			386		2,589						
			388			1,513					
The Coaldale Brick and Tile Co., Coaldale, Ala.	Dark-red vitrified paving bricks.	A	7563	10,563					0.44	0.98	Tested on edge.
		A	7564	8,485					0.22	0.49	Do.
		B	7565	6,206					1.2	2.6	Do.
		B	7566	7,657					0.24	0.54	Do.
		C	7567	8,016					4.2	9.2	Do.
		C	7568	9,094					2.9	6.6	Do.
		A	360		2,174						Do.
		C	361		1,569						Do.
The A. O. Jones Brick and Terra Cotta Co., Zanesville, Ohio.	Vitrified paving brick		7551	8,670					1.2	2.5	Do.
			7552	7,734					1.7	3.7	Do.
			7553	8,309					1.2	2.7	Do.
			348		1,865						Do.
Do	Vitrified paving block	Jones Pat. Z. O.	7554	9,302					0.9	2.0	Do.
Do	do	Jones Pat. Z. O.	7555	6,841					0.52	1.2	Do.
Do	do	Jones Pat. Z. O.	7556	7,319					1.2	2.7	Do.
Do	do	Jones Pat. Z. O.	349		1,377						Do.
Muscatine Terra Cotta Lumber Co., Muscatine, Iowa.			7693	9,962					1.5	3.2	Do.
			7694	11,046					1.4	3.1	Do.
			7695	8,894					1.4	3.1	Do.
			7696	11,451							
			7697	9,958							

		No. 1	7545	13,530						Do.
		No. 1	7546	12,050				4.3	8.4	Do.
Clark Press Brick Co., Malvern, Ark.	Hand made	No. 1	7547	12,574				6.1	11.5	Do.
		No. 2	7548	5,296				3.1	6.3	Do.
		No. 2	7549	3,127				2.8	5.8	Do.
		No. 2	7550	4,560						Do.
		No. 1	7582	5,343						Do.
		No. 2	7583	5,373				0.9	1.9	Do.
Noah Hamlet, Little Rock, Ark.		No. 3	7584	5,154						Do.
			7585	5,685						Do.
			7586	5,087				2.5	5.1	Do.
M. D. Hunton, Fort Smith, Ark.		No. 1	7610	4,800				2.7	6.2	Do.
		No. 1	7611	5,366				1.7	4.1	Do.
The Capital City Vitrified Brick and Paving Co., Topeka., Kans.	Vitrified brick		7589	7,611				1.9	4.3	Do.
Do	do		7590	8,233				2.8	6.1	Do.
Do	do		7591	8,792				1.7	3.8	Do.
Do	do		347		2,062					Do.
Monticello Brick Works, Monticello, Minn.		No. 1	7592	6,598				2.3	5.4	Do.
		No. 1	7593	21,665				1.9	4.6	Do.
A. Humphrey, Minneapolis, Minn.	Side cut		7598	19,866				0.25	0.58	Do.
Do	Dry clay, side cut		7599	14,723				0.25	0.58	Do.
Do	Dry clay, end cut		7600	8,749				0.23	0.54	Do.

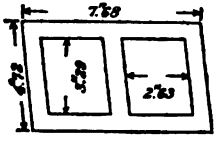
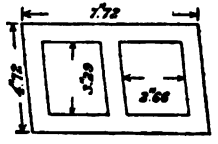
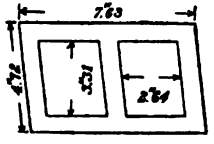
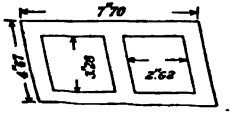
FIREPROOF BUILDING MATERIAL.

[Contributed by the Powhatan Clay Manufacturing Company, of Richmond, Va.]

No. of test.	End view.	Length.	Color.	Weight.		Sectional area.		First crack.	Ultimate strength.			Remarks.
						Gross.	Net.		Total.	Per square inch on gross section.	Per square inch on net section.	
		Inches.		*Pounds.*	*Ounces.*	*Sq. in.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
7836		11.32	Light red.....	12	12½	42.45	15.73	32,100 at A.	37,660	887	2,394	
7837		11.25	.....do.....	12	14	42.30	15.97	32,400 at A.	47,150	1,114	2,952	
7838		11.19	Medium light red.	12	12½	41.40	15.44	22,500	49,900	1,205	3,232	
7839		11.33	Red.....	13	0	42.37	15.41	29,900	46,800	1,104	3,037	

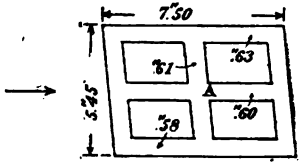
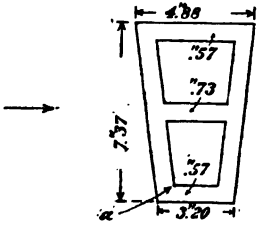
7840		11.18	....do	13	10½	40.58	14.05	80,200	62,750	1,546	4,263
7841		11.80	....do	13	1	41.58	15.59	34,800	46,180	1,111	2,962
7842		11.06	....do	13	10	39.60	14.51	85,100	51,400	1,289	3,542
7843		11.23	....do	12	14	40.99	14.98	87,400	68,710	1,676	4,602
7844		11.29	....do	15	3½	52.61	16.26	82,800	54,480	1,035	3,350
7845		11.26	....do	15	1½	52.81	15.80	89,900	81,080	1,535	5,071

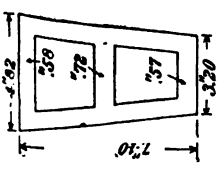
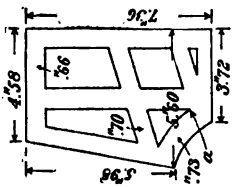
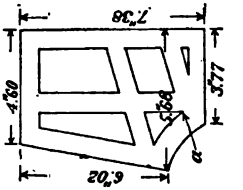
Fireproof building material—Continued.

No. of test.	End view.	Length.	Color.	Weight.		Sectional area.		First crack.	Ultimate strength.			Remarks.
						Gross.	Net.		Total.	Per square inch on gross section.	Per square inch on net section.	
		Inches.		*Pounds.*	*Ounces.*	*Sq. in.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
7846		11.24	Red.....	15	5	53.05	16.07	19,900	55,410	1,044	3,448	
7847		11.20	.....do	15	5	52.86	16.02	25,600	58,980	1,116	3,682	
7848		11.28	.....do	15	5½	53.24	15.90	27,200	62,140	1,167	3,908	
7849		11.11	.....do	15	1	51.88	15.44	36,900	49,950	963	3,235	

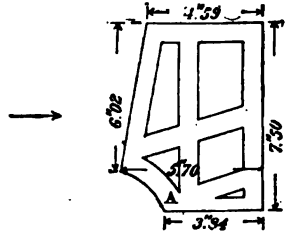
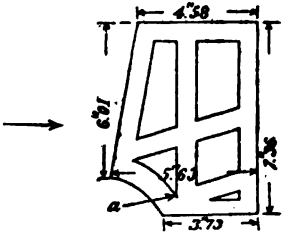
7850		11.18	.....do	15	1	52.66	15.88	35,800	55,860	1,061	3,518
7851		11.18	.....do	15	0	52.10	15.43	38,200	65,510	1,257	4,246
7852		11.16	Dark brown	18	1	50.82	20.53	34,900	93,580	1,564	4,558
7853		10.98	.....do	17	9	58.06	20.97	42,000	104,800	1,804	4,998
7854		10.82	Light brown.....	17	10	57.99	20.99	34,000 at A.	91,600	1,581	4,364

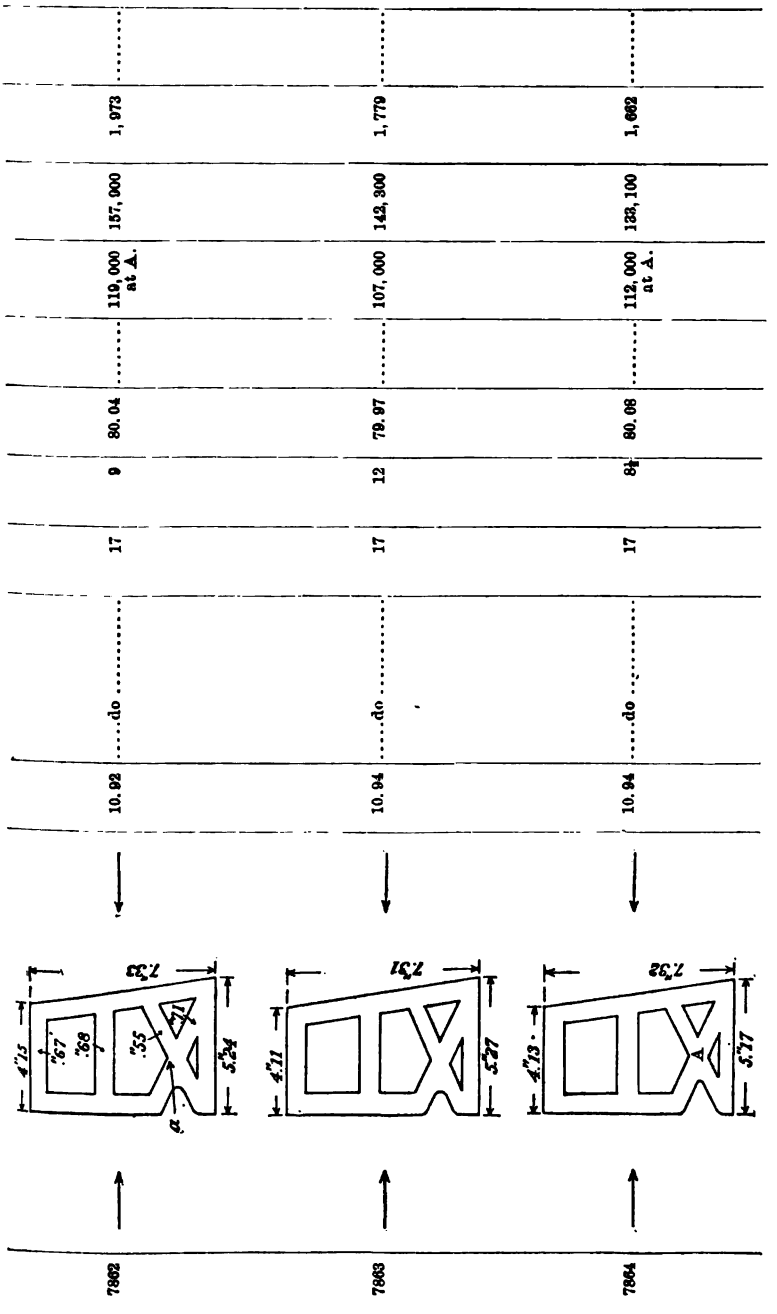
Fireproof building material—Continued.

No. of test.	End view.	Length.	Color.	Weight.		Sectional area.		First crack.	Ultimate strength.			Remarks.
						Gross.	Net.		Total.	Per square inch on gross section.	Per square inch on net section.	
		Inches.		*Pounds.*	*Ounces.*	*Sq. in.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
7855		11.16	Light brown.....	17	15	60.82	20.20	53,000 at A.	98,300	1,616	4,866	
7856		11.20	Red.....	11	15	82.54	20.94	73,000 at A.	99,200	1,202	4,737	

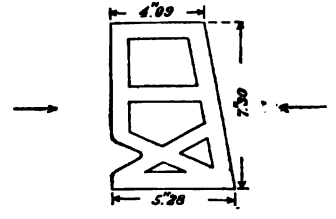
7857		11.83	do	12	0⅛	83.84	21.19	105,000	131,500	1,503	6,206
7858		10.96	Medium light red.	19	12	80.67		39,900 at A.	67,840	835	
7859		10.97	do	19	12	80.96		41,000 at A.	72,950	901	

Fireproof building material—Continued.

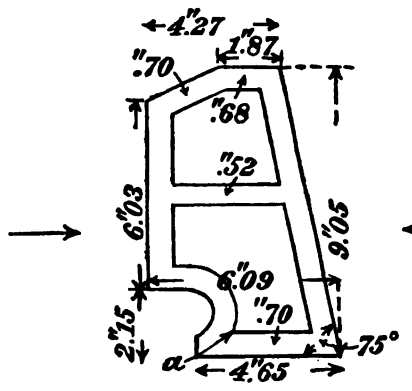
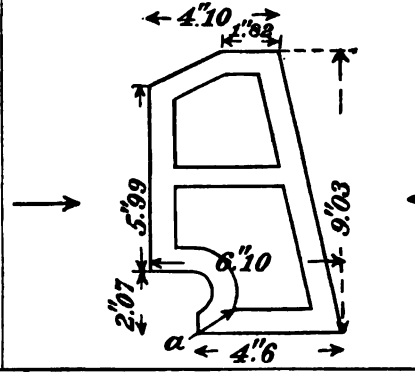
No. of test.	End view.	Length.	Color.	Weight.		Sectional area.		First crack.	Ultimate strength.			Remarks.
						Gross.	Net.		Total.	Per square inch on gross section.	Per square inch on net section.	
		Inches.		*Pounds.*	*Ounces.*	*Sq. in.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
7860		11.10	Red.....	20	1½	83.25	.....	34,900 at A.	63,800	766	.....	
7861		10.96	.....do	19	14	80.67	.....	39,200 at A.	77,680	963	.....	


7862
7863
7864
10.92
10.94
10.94
do
do
do
17
17
17
9
12
8½
80.04
79.97
80.08
119,000 at A.
107,000
112,000 at A.
157,900
143,300
133,100
1,973
1,779
1,662
7.33
7.31
7.32
4.75
4.67
.68
.55
.71
5.24
a
4.11
5.27
4.73
A
5.27

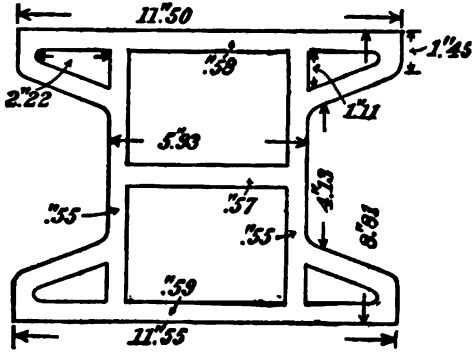
Fireproof building material—Continued.

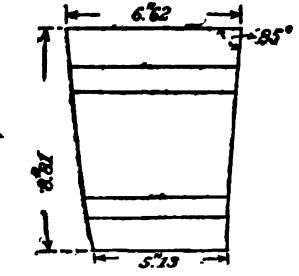
No. of test.	End view.	Length.	Color.	Weight.		Sectional area.		First crack.	Ultimate strength.			Remarks.
						Gross.	Net.		Total.	Per square inch on gross section.	Per square inch on net section.	
		Inches.		*Pounds.*	*Ounces.*	*Sq. in.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
7865		10.84	Red	17	8½	79.13	.....	116,000	130,500	1,649	.....	

[Contributed by Gladding, McBean & Co., San Francisco, Cal.]

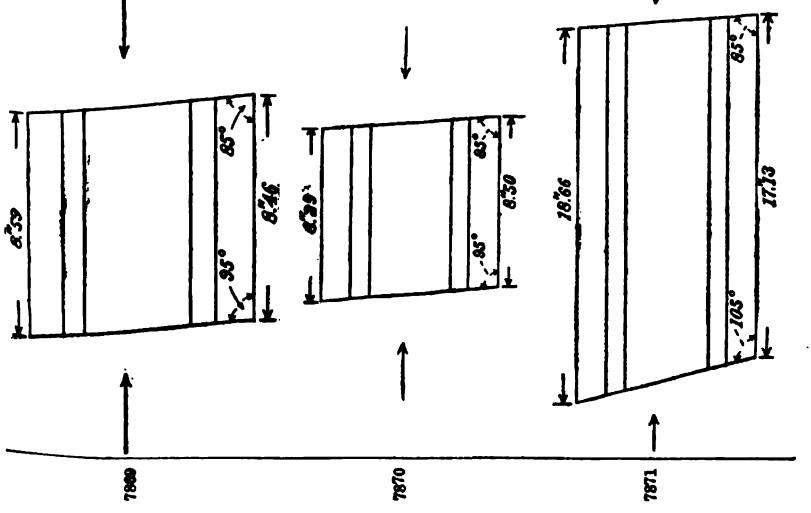
No. of test.	End view.	Length.	Description.	Color.	Weight.		First crack.	Ultimate strength.	Remarks.
		Inches.			*Lbs.*	*Ounces.*	*Pounds.*	*Pounds.*	
7866		11.88	Butment tile, 9″ end pressure arch.	Dark buff.....	15	7½	24,900 at A.	29,950	
7867		11.90	.....do.....	Light buff....	15	2	20,900 at A.	29,600	

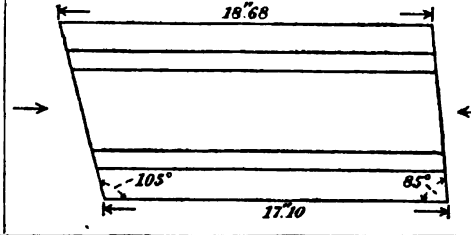
End view of Nos. 7868-7872.

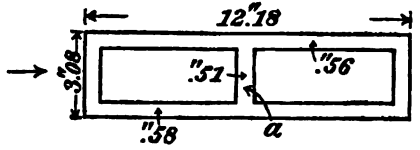
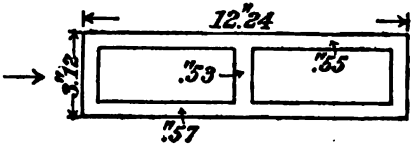
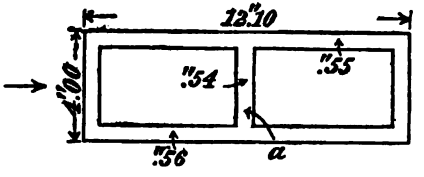


No. of test.	Side view.	Description.	Color.	Weight.		Net sectional area.	First crack.	Ultimate strength.		Remarks.
								Total.	Per square inch.	
				Pounds.	*Ounces.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7868		9" end pressure arch. No. 6 key tile.	Dark buff...	12	9	34.33	102,800	102,800	2,994	

7869	9" end pressure arch. No. 5 inter tile.	....do	20	9	34.33	135,960	3,960
7870	9" end pressure arch. No. 5 inter tile.	....do	19	14	34.33	145,960	4,252
7871	9" end pressure arch. No. 1 inter tile.	Buff	41	8	34.33	116,000	3,538

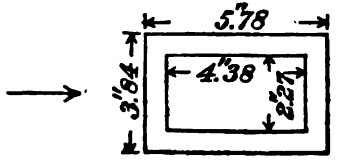
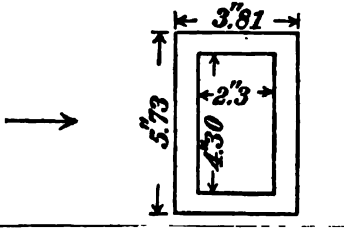


No. of test.	Side view.	Description.	Color.	Weight.		Net sectional area.	First crack.	Ultimate strength.		Remarks.
								Total.	Per square inch.	
				Pounds.	*Ounces.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7872		9" end pressure arch. No. 1 inter tile.	Light buff..	42	8	34.38	113,000	134,200	3,909	

No. of test.	End view.	Length.	Color.	Weight.		Sectional area.		First crack.	Ultimate strength.			Remarks.
						Gross.	Net.		Total.	Per square inch on gross section.	Per square inch on net section.	
				Pounds.	*Ounces.*	*Sq. in.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
7873		12.05	Light brown.	15	0	37.11	13.74	42,900 at A.	42,900	1,156	3,122	3″ partition tile.
7874		12.12	Dark brown.	15	0	37.81	13.57	44,200	44,500	1,177	3,279	Do.
7875		12.05	Dark buff...	15	7	48.20	13.38	25,900 at A.	33,020	685	2,468	4″ partition tile.

BUILDING BLOCKS.

[Contributed by Muscatine Terra Cotta Lumber Company, Muscatine, Iowa.]

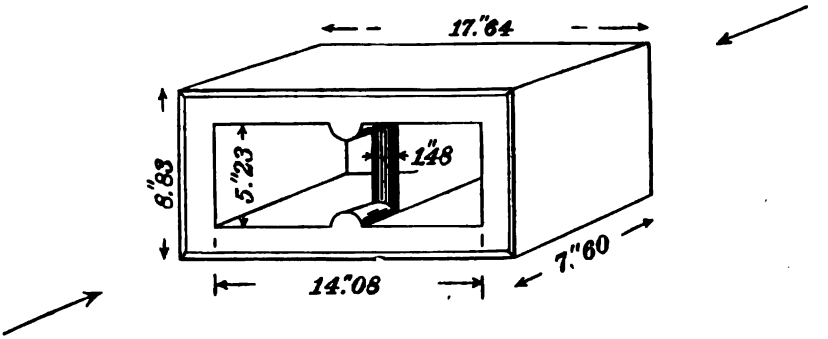
No. of test.	End view.	Length.	Color.	Weight.		Sectional area.		First crack.	Ultimate strength.			Remarks.
						Gross.	Net.		Total.	Per square inch on gross section.	Per square inch on net section.	
				Pounds.	*Ounces.*	*Sq. in.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
7698		12.05				46.27	18.92	55,000	94,300	2,038	4,984	
7699		11.90				68.19	17.02	18,000	81,700	1,198	4,800	

BUILDING BLOCKS.

[Contributed by the Akron Fire Brick Company, Akron, Ohio.]

No. 7408.

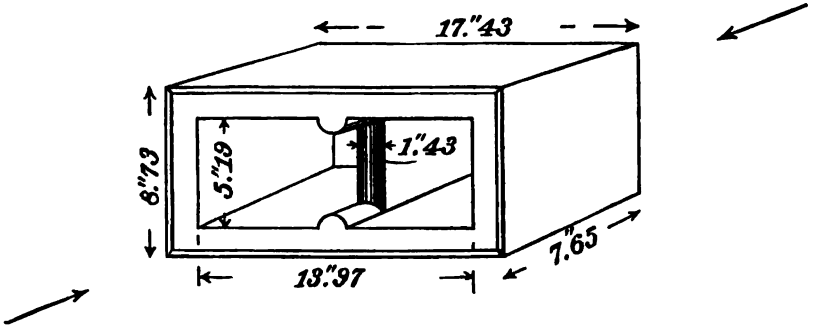
No. 1, buff.



Weight, 53 pounds.
Gross sectional area, 8.″83×17.″64=155.76 square inches.
Net sectional area, 82.84 square inches.
First crack at 360,000 pounds.
Ultimate strength 484,800 pounds=3,112 pounds per square inch on gross section; 5,852 pounds per square inch on net section.

No. 7409.

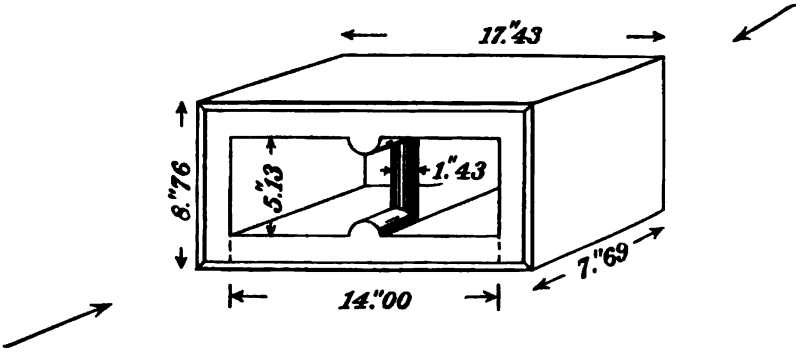
No. 2, yellow.



Weight, 52¾ pounds.
Gross sectional area, 8.″73×17.″43=152.16 square inches.
Net sectional area, 81.26 square inches.
First crack at 392,000 pounds.
Ultimate strengh 475,600 pounds=3,126 pounds per square inch on gross section; 5,853 pounds per square inch on net section.

No. 7410.

No. 3, red.

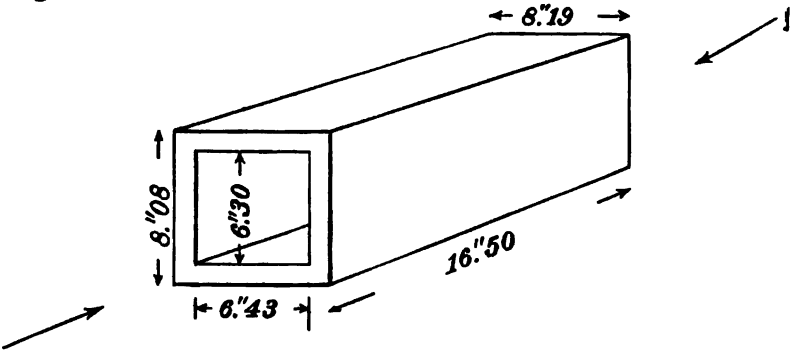


Weight, 52¾ pounds.
Gross sectional area, 8".76×17".43=152.69 square inches.
Net sectional area, 82.48 square inches.
First crack at 332,000 pounds.
Ultimate strength, 363,000 pounds=2,381 pounds per square inch on gross section; 4,408 pounds per square inch on net section.

No. 7411.

No. 4, dark brown.

Figured surface on one side of block.

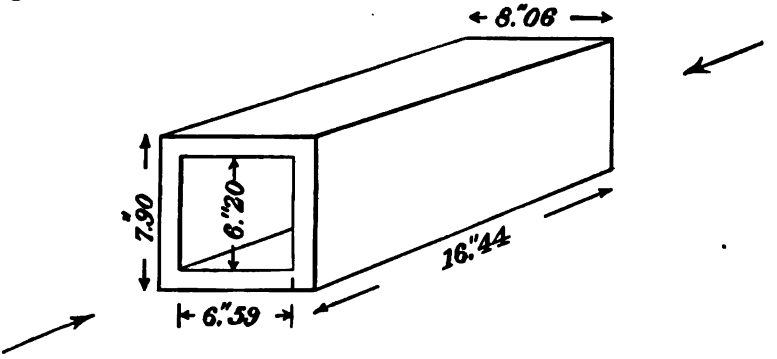


Weight, 33¼ pounds.
Gross sectional area, 8".08×8".19=66.17 square inches.
Net sectional area, 25.66 square inches.
Ultimate strength, 132,100 pounds=1,996 pounds per square inch on gross section; 5,148 pounds per square inch on net section.

No. 7412.

No. 5, brown.

Figured surface on one side of block.



Weight, 32 pounds.
Gross sectional area, 7".9×8".06=63.67 square inches.
Net sectional area, 22.81 square inches.
First crack at 109,000 pounds.
Ultimate strength, 282,500 pounds=4,437 pounds per square inch on gross section; 12,384 pounds per square inch on net section.

COMPRESSION TESTS OF DOUGLAS FIR WOOD.

DOUGLAS FIR.

Compression tests of Douglas fir, commonly known as Oregon pine, from the State of Washington, district of Puget Sound. Botanical name, *Pseudotsuga Douglassi.*

Material contributed for testing purposes by the Pacific Pine Lumber Company, San Francisco, Cal.

DESCRIPTION OF MATERIAL.

Wood not seasoned; lying in the water until sawed, May 10, 1894. Tests made in April and May, 1895.

Marks.	Nominal size.	Length.	Age of tree.	Diameter of tree 4 feet from stump.	When felled.	County.	Character of soil.
	Inches.	*Feet.*	*Years.*	*Inches.*			
No. 1.....	8×10	28	450	54	Spring, 1894.....	King.....	Clay.
No. 9.....	10×12	26	375	45	Summer, 1893 ...	Snohomish ...	Do.
No. 4.....	10×10	26	400	48	.....do	Skagit.....	Gravel.
No. 5.....	8×10	28	300	36	.....do	Whatcom	Clay loam.
No. 2.....	10×12	24	300	36	.....do	.....do.....	Clay.
No. 3.....	10×10	26	450	54	Spring, 1894.....	King.....	Do.
No. 6.....	8×10	28	375	45	Summer, 1893 ...	Snohomish ...	Do.
No. 8.....	10×12	24	450	54	Spring, 1894.....	King.....	Do.
No. 16....	10×10	22	375	45	Summer, 1893 ...	Snohomish ...	Clay loam.
No. 32....	8×8	28	266	30	.....do	Mason.....	Gravel.

The longer sticks furnished one or more samples for testing. The distinguishing marks of each stick are retained on the several samples taken therefrom.

After the material was received and pending the time of testing, it was stored in a cool, dry building.

The weights and dimensions were ascertained at the time of testing.

The sticks were tested with flat ends.

The direction of the rings of annual growth is shown on the sketch preceding each test, and the direction of final deflection indicated by an arrow.

Micrometer observations show the compression of the wood within the gauged length under different loads, and at intervals the sets developed.

The behavior of the wood under ascending and descending loads was investigated and the effect of prolonged stress ascertained both with regard to longitudinal compression and lateral deflection, as well as upon the ultimate strength of the material.

The lateral expansion of the wood accompanying the longitudinal compression was also determined. The lateral expansion was found to vary considerably at different parts of the length of the post.

In test No. 1401 loads were successively applied, beginning at the initial load of 100 pounds per square inch, and the compressions and deflections measured for each increment of load thereafter.

After loads of 500, 1,000, 2,000, and 2,600 pounds per square inch the sets were determined, releasing the loads to 100 pounds per square inch for the purpose.

When 2,000 pounds per square inch was reached for the first time, the load was gradually released and micrometer observations taken on the resilience of the post. Reapplying the load, measurements were taken as the stresses were increased.

The path described by the post was not the same under descending

and ascending loads, but showed a behavior similar to that which has been observed in overstrained steel, and shown more conspicuously in the tensile tests of cordage. There is a retardation in the release of strains.

The ultimate strength of this post was 2,600 pounds per square inch. Rapid failure did not take place upon reaching this load, which was sustained in all for a period of 35 minutes, during which time, however, the post continued to deflect with an accelerating rate.

Evidently a higher ultimate strength might apparently have been shown by more rapid loading as the maximum stress was approached. The micrometer readings, however, showed an increased rate of compression under the increments of load immediately preceding the maximum stress.

From these indications it would seem that the element of time was important, and that a higher or lower ultimate strength might be made to appear, according to the speed of testing.

After the post had been given a large permanent deflection while under the maximum stress, the load was released to 100 pounds per square inch and then gradually reapplied. At 1,800 pounds per square inch the immediate vertical deflection of 2″ was increased to 2″.20 at the expiration of 25 minutes. Still further increasing the load, under 2,100 pounds per square inch, a more rapid rate of deflection took place.

Gradually releasing the load and again reapplying it, the vertical deflection, this being the principal direction of deflection, displayed the same kind of behavior previously noted in the longitudinal compression of the post; namely, a retardation in recovery whereby the paths of the deflections take different courses under descending and ascending stresses.

In the test of post No. 1402 there are shown examples of the recovery of a part of the immediate set given by higher loads.

On the gauged length of 250″ the immediate set caused by a load of 3,000 pounds per square inch was ″.0114, which was diminished to ″.0049 after the expiration of 14 hours. The interval of 5 minutes showed a recovery from ″.0224 to ″.0188 following the release of the load 3,500 pounds per square inch.

The gradual increase in the amount of longitudinal compression and lateral deflections of post No. 1403 was observed over a longer period of time than in the preceding tests.

The load was arrested at 2,700 pounds per square inch, and there maintained for 5 hours 30 minutes, after which it was released to 100 pounds per square inch, where it remained with some change over night, and was then increased to 2,700 pounds per square inch as before and held for an additional period of 1 hour 10 minutes.

The rate of longitudinal compression was remarkably uniform with slight acceleration up to the load 2,700 pounds per square inch.

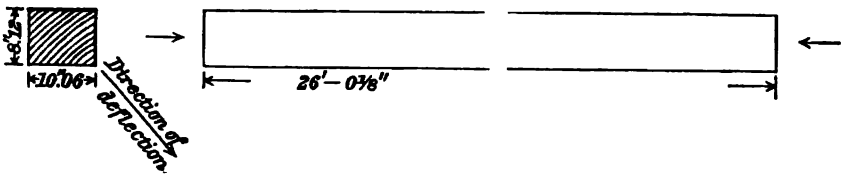
The increase in compression and in deflection progressed slowly under the maximum load until a comparatively large deflection was reached. Not until near the end of the test were these movements very rapid.

The immediate set prior to the rest of 14 hours under the initial load was found ″.0740, which recovered to ″.0650 at the end of 5 minutes, and showed a further recovery to ″.0420 at the end of the 14 hours interval.

The total load left on the post at night was 10,220 pounds; 14 hours later the load was found to be 18,100 pounds, which gain was attributed to the recovery in length of the post which occurred in meantime.

The behavior of this post further indicates that some vagueness attends the definition of the ultimate strength of a long wooden post, the element of time being an important function.

No. 1401.



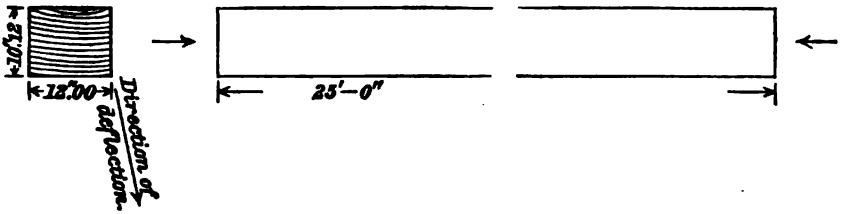
Marks, No. 1.
Weight, 481½ pounds=32.6 pounds per cubic foot.
Specific gravity, .5216.
Rate of growth, 12 rings per inch.
Sectional area, 81.68 square inches.
Gauged length, 250″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inches.*	
8,168	100	0.	0.	0.	0.	Initial load.
16,336	200	.0155	.....	0.	0.	
24,504	300	.0303	.....	0.	0.	
32,672	400	.0452	.....	0.	0.	
40,840	500	.0602	.....	0.	—.01	
8,168	100	.....	.0014	0.	0.	
49,008	600	.0753	.....	0.	0.	
57,176	700	.0902	.....	0.	0.	
65,344	800	.1050	.....	0.	—.02	
73,512	900	.1199	.....	0.	—.03	
81,680	1,000	.1354	.....	—.01	0.	
8,168	100	.....	.0027	0.	0.	
89,848	1,100	.1506	.....	—.02	—.04	
98,016	1,200	.1668	.....	—.03	—.06	
106,184	1,300	.1822	.....	—.05	—.08	
114,352	1,400	.1977	.....	—.07	—.10	Rested under load 10 minutes.
122,520	1,500	.2174	.....	—.08	—.10	
130,688	1,600	.2328	.....	—.09	—.11	
138,856	1,700	.2486	.....	—.10	—.12	
147,024	1,800	.2653	.....	—.11	—.14	
155,192	1,900	.2814	.....	—.12	—.17	
163,360	2,000	.2979	.....	—.13	—.20	
147,024	1,800	.2680	.....	.....	.....	E=1,651,000 pounds per square inch.
130,688	1,600	.2370	.....	.....	.....	
114,352	1,400	.2066	.....	.....	.....	
98,016	1,200	.1757	.....	.....	.....	
81,680	1,000	.1454	.....	.....	.....	
65,344	800	.1154	.....	.....	.....	
49,008	600	.0855	.....	.....	.....	
32,672	400	.0555	.....	.....	.....	
16,336	200	.0258	.....	.....	.....	
8,168	100	.....	.0102	0.	0.	
16,336	200	.0241	.....	.....	.....	
32,672	400	.0538	.....	.....	.....	
49,008	600	.0834	.....	.....	.....	
65,344	800	.1130	.....	.....	.....	
81,680	1,000	.1431	.....	.....	.....	
98,016	1,200	.1732	.....	.....	.....	
114,352	1,400	.2033	.....	.....	.....	
130,688	1,600	.2345	.....	.....	.....	
147,024	1,800	.2655	.....	.....	.....	
163,360	2,000	.2975	.....	—.13	—.20	
171,528	2,100	.3164	.....	—.15	—.22	
179,696	2,200	.3334	.....	—.17	—.26	
187,864	2,300	.3514	.....	—.19	—.29	
196,032	2,400	.3694	.....	—.21	—.33	
204,200	2,500	.3892	.....	—.22	—.40	
212,368	2,600	.4115	.....	—.26	—.50	Ultimate strength.
.....	2,600	.4300	.....	—.31	—.67	After 5 minutes.

No. 1401—Continued.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inches.*	
8,168	100	.....	.0233	—.01	— .04	
.....	100	.....	.0222	—.01	— .04	After 5 minutes.
212,368	2,600	.....	.....	—.30	— .62	
.....	2,600	.....	.....	—.33	— .76	Do.
.....	2,600	.....	.....	—.37	— .83	After 10 minutes.
.....	2,600	.....	.....	—.39	— .94	After 15 minutes.
.....	2,600	.....	.....	—.40	—1.12	After 20 minutes.
.....	2,600	.....	.....	—.42	—1.31	After 25 minutes.
.....	2,600	.....	.....	—.45	—2.60	After 30 minutes.
At the expiration of 30 minutes the post yielded rapidly, deflecting downward and to a less extent in a horizontal direction. The fibers crushed on the compression side of the bent post 18″ from the end. Failed by triple flexure.						
8,168	100	.....	.....	—.18	— .68	
16,336	200	.....	.....	—.20	— .70	
32,672	400	.....	.....	—.20	— .72	
49,008	600	.....	.....	—.21	— .80	No change after 5 minutes
65,344	800	.....	.....	—.26	— .90	
81,680	1,000	.....	.....	—.30	—1.03	
98,016	1,200	.....	.....	—.33	—1.20	
114,352	1,400	.....	.....	—.39	—1.40	
130,688	1,600	.....	.....	—.43	—1.63	
147,024	1,800	.....	.....	—.50	—2.00	
.....	1,800	.....	.....	—.51	—2.10	After 5 minutes.
.....	1,800	.....	.....	—.52	—2.12	After 10 minutes.
.....	1,800	.....	.....	—.53	—2.18	After 15 minutes.
.....	1,800	.....	.....	—.53	—2.19	After 20 minutes.
.....	1,800	.....	.....	—.53	—2.20	After 25 minutes.
163,360	2,000	.....	.....	—.60	—2.53	
171,528	2,100	.....	.....	—.65	—2.80	
.....	2,100	.....	.....	—.70	—3.20	After 5 minutes.
.....	2,100	.....	.....	—.72	—3.30	After 6 minutes.
163,360	2,000	.....	.....	—.70	—3.10	
130,688	1,600	.....	.....	—.57	—2.38	
98,016	1,200	.....	.....	—.49	—1.89	
65,344	800	.....	.....	—.39	—1.49	
32,672	400	.....	.....	—.29	—1.10	
8,168	100	.....	.....	—.20	— .85	
32,672	400	.....	.....	—.22	— .90	
65,344	800	.....	.....	—.30	—1.13	
98,016	1,200	.....	.....	—.40	—1.49	
130,688	1,600	.....	.....	—.50	—1.96	
163,360	2,000	.....	.....	—.64	—2.80	
8,168	100	.....	.....	—.20	— .82	

No. 1402.



Marks, No. 9.
Weight, 777 pounds=36.8 pounds per cubic foot.
Specific gravity, .5896.
Rate of growth, 12 rings per inch.
Sectional area, 121.44 square inches.
Gauged length, 250″.
Counterweighted at middle.

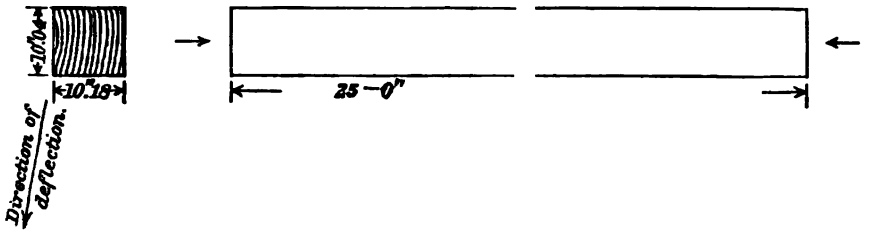
Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
12,144	100	0.	0.	0.	0.	Initial load.
24,288	200	.0134	.....	0.	0.	
36,432	300	.0287	.....	0.	0.	
48,576	400	.0399	.....	0.	0.	
60,720	500	.0535	.....	0.	0.	
72,864	600	.0668	.....	0.	0.	
85,008	700	.0800	.....	0.	—.01	
97,152	800	.0934	.....	0.	—.01	
109,296	900	.1066	.....	0.	—.02	
121,440	1,000	.1200	.....	0.	—.02	
12,144	100	.....	.0006 —.0003	0.	0.	After 2 minutes rest.
121,440	1,000	.1185	.....	.....	.....	
145,728	1,100	.1321	.....	0.	—.02	
145,728	1,200	.1456	.....	0.	—.03	
157,872	1,300	.1591	.....	0.	—.03	
170,016	1,400	.1729	.....	0.	—.03	
182,160	1,500	.1864	.....	0.	—.04	
194,304	1,600	.1998	.....	0.	—.05	
206,448	1,700	.2135	.....	0.	—.06	
218,592	1,800	.2272	.....	0.	—.07	
230,736	1,900	.2413	.....	—.01	—.09	
242,880	2,000	.2554	.....	—.01	—.09	E = 1,875,000 pounds per square inch.
12,144	100	.....	.0021	0.	0.	
255,024	2,100	.2677	.....	—.01	—.09	
267,168	2,200	.2822	.....	—.01	—.09	
279,312	2,300	.2960	.....	—.01	—.11	
291,456	2,400	.3110	.....	—.01	—.12	
303,600	2,500	.3255	.....	—.01	—.13	
315,744	2,600	.3409	.....	—.01	—.13	
327,888	2,700	.3554	.....	—.02	—.15	
340,032	2,800	.3719	.....	—.02	—.16	
352,176	2,900	.3867	.....	—.02	—.19	
364,320	3,000	.4021	.....	—.03	—.20	
303,600	2,500	.3352	.....	.....	.....	
242,880	2,000	.2672	.....	.....	.....	
182,160	1,500	.1989	.....	.....	.....	
121,440	1,000	.1325	.....	.....	.....	
60,720	500	.0645	.....	.....	.....	
12,144	100	.....	.0104	0.	—.01	
60,720	500	.0619	.....	.....	.....	
121,440	1,000	.1280	.....	.....	.....	
182,160	1,500	.1948	.....	.....	.....	
242,880	2,000	.2630	.....	.....	.....	
303,600	2,500	.3316	.....	.....	.....	
364,320	3,000	.4025	.....	.....	.....	
12,144	100	.....	.0114	.....	.....	

No. 1402—Continued.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
.....	100	.....	.0049	.....	.....	After resting 14 hours.
364, 320	3, 000	.3968	.....	—.08	—.19	
376, 464	3, 100	.4189	.....	—.03	—.20	
388, 608	3, 200	.4356	.....	—.05	—.22	
400, 752	3, 300	.4526	.....	—.06	—.24	
412, 896	3, 400	.4716	.....	—.07	—.29	
425, 040	3, 500	.4985	.....	—.10	—.35	
364, 320	3, 000	.4313	.....	.....	.....	
303, 600	2, 500	.3613	.....	.....	.....	
242, 880	2, 000	.2907	.....	.....	.....	
182, 160	1, 500	.2217	.....	.....	.....	
121, 440	1, 000	.1518	.....	.....	.....	
60, 720	500	.0809	.....	.....	.....	
12, 144	100	.....	.0224	0.	—.04	
.....	100	.....	.0188	.....	.....	After 5 minutes.
60, 720	500	.0712	.....	.....	.....	
121, 440	1, 000	.1383	.....	.....	.....	
182, 160	1, 500	.2075	.....	.....	.....	
242, 880	2, 000	.2776	.....	.....	.....	
303, 600	2, 500	.3499	.....	.....	.....	
364, 320	3, 000	.4237	.....	.....	.....	
425, 040	3, 500	.5018	.....	—.10	—.37	
437, 184	3, 600	.5345	.....	—.12	—.50	
449, 328	3, 700	.5665	.....	—.19	—.63	
.....	3, 700	.5970	.....	—.20	—.81	After 2 minutes.
12, 144	100	.....	.0456	—.01	—.14	
449, 328	3, 700	.....	.....	—.21	—.95	Ultimate strength.

Failed by triple flexure.

No. 1403.



Marks, No. 4.
Weight, 613 pounds=34.5 pounds per cubic foot.
Specific gravity, .5520
Rate of growth, 10 rings per inch.
Sectional area, 102.20 square inches.
Gauged length, 250″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inches.*	
10,220	100	0.	0.	0.	0.	Initial load.
20,440	200	.0140	.....	0.	0.	
30,660	300	.0279	.....	0.	0.	
40,880	400	.0418	.....	+.01	—.01	
51,100	500	.0557	.....	.02	—.01	
61,320	600	.0697	.....	.03	—.02	
71,540	700	.0836	.....	.04	—.03	
81,760	800	.0979	.....	.06	—.05	
91,980	900	.1119	.....	.06	—.07	
102,200	1,000	.1262	.....	.07	—.07	
10,220	100	.....	.0024	0.	0.	
112,420	1,100	.1403	.....	.08	—.08	
122,640	1,200	.1549	.....	.09	—.09	
132,860	1,300	.1693	.....	.09	—.10	
143,080	1,400	.1840	.....	.10	—.11	
153,300	1,500	.1986	.....	.10	—.12	
163,520	1,600	.2132	.....	.10	—.13	
173,740	1,700	.2280	.....	.11	—.15	
183,960	1,800	.2428	.....	.11	—.17	
194,180	1,900	.2578	.....	.11	—.18	
204,400	2,000	.2728	.....	.11	—.19	E=1,785,000 pounds per square inch.
10,220	100	.....	.0069	.01	0.	
214,620	2,100	.2857	.....	.12	—.20	
224,840	2,200	.3020	.....	.12	—.23	
235,060	2,300	.3178	.....	.14	—.24	
245,280	2,400	.3338	.....	.17	—.27	
255,500	2,500	.3497	.....	.18	—.29	
265,720	2,600	.3660	.....	.20	—.30	
275,940	2,700	.3841	.....	.20	—.35	Ultimate strength.
.....	2,700	.3880	.....	.20	—.37	After 5 minutes.
.....	2,700	.3916	.....	.20	—.38	After 10 minutes.
.....	2,700	.3947	.....	.21	—.40	After 15 minutes.
.....	2,700	.3965	.....	.21	—.40	After 20 minutes.
.....	2,700	.3984	.....	.21	—.41	After 25 minutes.
.....	2,700	.4004	.....	.22	—.42	After 30 minutes.
.....	2,700	.4020	.....	.22	—.42	After 35 minutes.
.....	2,700	.4040	.....	.23	—.43	After 40 minutes.
.....	2,700	.4055	.....	.....	.....	After 45 minutes.
.....	2,700	.4102	.....	.....	.....	After 60 minutes.
.....	2,700	.4206	.....	.30	—.50	After 1 hour 40 minutes.
.....	2,700	.4262	.....	.31	—.52	After 2 hours.
.....	2,700	.4278	.....	.30	—.54	After 2 hours 10 minutes.
.....	2,700	.4293	.....	.31	—.56	After 2 hours 15 minutes.
.....	2,700	.4307	.....	.31	—.57	After 2 hours 20 minutes.
.....	2,700	.4317	.....	.31	—.59	After 2 hours 25 minutes.

No. 1403—Continued.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inches.*	
.....	2,700	.4331	.....	.31	— .60	After 2 hours 30 minutes.
.....	2,700	.4342	.....	.31	— .60	After 2 hours 35 minutes.
.....	2,700	.4355	.....	.31	— .60	After 2 hours 40 minutes.
.....	2,700	.4368	.....	.31	— .60	After 2 hours 45 minutes.
.....	2,700	.4380	.....	.32	— .61	After 2 hours 50 minutes.
.....	2,700	.4395	.....	.32	— .61	After 2 hours 55 minutes.
.....	2,700	.4409	.....	.32	— .62	After 3 hours.
.....	2,700	.4426	.....	.32	— .63	After 3 hours 5 minutes.
.....	2,700	.4440	.....	.32	— .65	After 3 hours 10 minutes.
.....	2,700	.4456	.....	.33	— .68	After 3 hours 15 minutes.
.....	2,700	.4469	.....	.34	— .69	After 3 hours 20 minutes.
.....	2,700	.4482	.....	.34	— .69	After 3 hours 25 minutes.
.....	2,700	.4494	.....	.37	— .70	After 3 hours 30 minutes.
.....	2,700	.4509	.....	.38	— .70	After 3 hours 35 minutes.
.....	2,700	.4525	.....	.38	— .72	After 3 hours 40 minutes.
.....	2,700	.4540	.....	.39	— .73	After 3 hours 45 minutes.
.....	2,700	.4555	.....	.39	— .74	After 3 hours 50 minutes.
.....	2,700	.4570	.....	.39	— .77	After 3 hours 55 minutes.
.....	2,700	.4585	.....	.40	— .78	After 4 hours.
.....	2,700	.4604	.....	.40	— .80	After 4 hours 5 minutes.
.....	2,700	.4621	.....	.41	— .80	After 4 hours 10 minutes.
.....	2,700	.4638	.....	.40	— .81	After 4 hours 15 minutes.
.....	2,700	.4659	.....	.40	— .82	After 4 hours 20 minutes.
.....	2,700	.4681	.....	.42	— .83	After 4 hours 25 minutes.
.....	2,700	.4706	.....	.42	— .86	After 4 hours 30 minutes.
.....	2,700	.4727	.....	.42	— .88	After 4 hours 35 minutes.
.....	2,700	.4752	.....	.42	— .89	After 4 hours 40 minutes.
.....	2,700	.4775	.....	.44	— .90	After 4 hours 45 minutes.
.....	2,700	.4801	.....	.46	— .92	After 4 hours 50 minutes.
.....	2,700	.4823	.....	.47	— .96	After 4 hours 55 minutes.
.....	2,700	.4845	.....	.49	— .98	After 5 hours.
.....	2,700	.4869	.....	.49	— .99	After 5 hours 5 minutes.
.....	2,700	.4894	.....	.50	—1.00	After 5 hours 10 minutes.
.....	2,700	.4921	.....	.50	—1.04	After 5 hours 15 minutes.
.....	2,700	.4951	.....	.50	—1.06	After 5 hours 20 minutes.
.....	2,700	.4981	.....	.50	—1.09	After 5 hours 25 minutes.
.....	2,700	.5015	.....	.51	—1.10	After 5 hours 30 minutes.
10,220	100	.....	.0740	.15	— .27	
.....	100	.....	.0650	.....	.....	After 5 minutes.

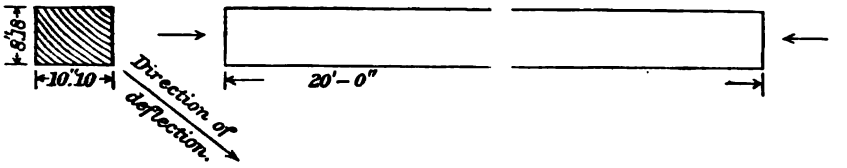
Post remained in the testing machine over night, a period of 14 hours, during which time the total load increased from 10,220 pounds to 18,100. Increase of load attributed to recovery of set in post.

Load released to 100 pounds per square inch.

10,220	100	.....	.0420	.....	.....	
.....	2,700	0.4673	.....	0.50	—0.98	
.....	2,700	.4810	.....	.51	—1.03	After 5 minutes.
.....	2,700	.4903	.....	.52	—1.10	After 10 minutes.
.....	2,700	.4959	.....	.53	—1.12	After 15 minutes.
.....	2,700	.5026	.....	.58	—1.18	After 20 minutes.
.....	2,700	.5073	.....	.59	—1.20	After 25 minutes.
.....	2,700	.5140	.....	.59	—1.29	After 30 minutes.
.....	2,700	.5195	.....	.60	—1.30	After 35 minutes.
.....	2,700	.5264	.....	.62	—1.37	After 40 minutes.
.....	2,700	.5347	.....	.67	—1.43	After 45 minutes.
.....	2,700	.5419	.....	.60	—1.49	After 50 minutes.
.....	2,700	.5505	.....	.70	—1.58	After 55 minutes.
.....	2,700	.5624	.....	.74	—1.69	After 60 minutes.
.....	2,700	.5770	.....	.80	—1.80	After 1 hour 5 minutes.
.....	2,700	.6020	.....	.90	—2.00	After 1 hour 10 minutes.

Failed by triple flexure, by deflecting obliquely downward. No local crushing of fibers visible at the end of the test.

No. 1404.

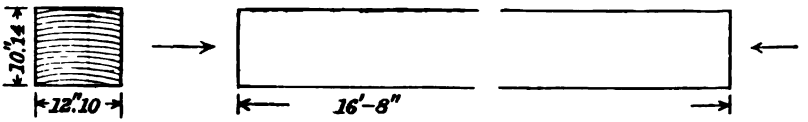


Marks, No. 5.
Weight, 378½ pounds=33 pounds per cubic foot.
Specific gravity, .5280.
Rate of growth, 12 rings per inch.
Sectional area, 82.62 square inches.
Gauged length, 200″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
8,262	100	0.	0.	0.	0.	Initial load.
16,524	200	.0121	.....	0.	0.	
24,786	300	.0240	.....	0.	0.	
33,048	400	.0363	.....	0.	0.	
41,310	500	.0479	.....	0.	0.	
49,572	600	.0600	.....	0.	0.	
57,834	700	.0716	.....	0.	0.	
66,096	800	.0835	.....	—.01	0.	
74,358	900	.0957	.....	—.01	0.	
82,620	1,000	.1073	.....	—.01	0.	
8,262	100	.....	.0018	0.	0.	
90,882	1,100	.1190	.....	—.02	0.	
99,144	1,200	.1310	.....	—.03	0.	
107,406	1,300	.1434	.....	—.04	0.	
115,668	1,400	.1552	.....	—.04	0.	
123,930	1,500	.1672	.....	—.04	0.	
132,192	1,600	.1794	.....	—.05	0.	
140,454	1,700	.1911	.....	—.05	0.	
148,716	1,800	.2030	.....	—.06	—.01	
156,978	1,900	.2153	.....	—.09	—.02	
165,240	2,000	.2272	.....	—.09	—.02	E=1,704,000 pounds per square inch.
8,262	100	.....	.0042	0.	0.	
173,502	2,100	.2380	.....	—.10	—.02	
181,764	2,200	.2519	.....	—.10	—.02	
190,026	2,300	.2647	.....	—.11	—.02	
198,288	2,400	.2772	.....	—.11	—.02	
206,550	2,500	.2903	.....	—.11	—.02	
214,812	2,600	.3025	.....	—.12	—.02	
223,074	2,700	.3158	.....	—.13	—.02	
231,336	2,800	.3297	.....	—.15	—.02	
239,598	2,900	.3441	.....	—.17	—.02	
247,860	3,000	.3595	.....	—.19	—.02	
8,262	100	.....	.0116	0.	0.	
256,122	3,100	.3766	.....	—.21	—.02	
264,384	3,200	.4040	.....	—.29	—.02	
272,646	3,300	.4480	.....	—.39	—.05	
8,262	100	.....	.0355	—.08	0.	
.....	100	.....	.0225	—.02	0.	After 1 hour.
278,500	3,371	.....	.....	—.70	—.60	Ultimate strength.

Failed by triple flexure. Deflected horizontally and downward. Fibers crushed 2″ from middle of length of post.

No. 1405.

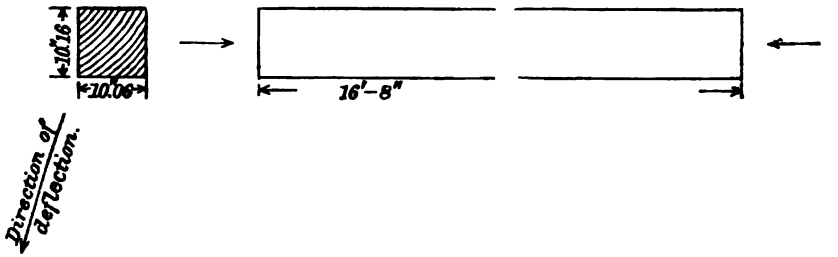


Marks, No. 2.
Weight, 478 pounds=33.6 pounds per cubic foot.
Specific gravity, .5376.
Rate of growth, 15 rings per inch.
Sectional area, 122.69 square inches.
Gauged length, 150".
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
12,269	100	0.	0.	0.	0.	Initial load.
24,538	200	.0064	.....	0.	0.	
36,807	300	.0134	.....	0.	0.	
49,076	400	.0209	.....	0.	+.01	
61,345	500	.0283	.....	0.	+.01	
73,614	600	.0361	.....	0.	.02	
85,883	700	.0439	.....	—.01	.02	
98,152	800	.0518	.....	—.01	.02	
110,421	900	.0599	.....	—.01	.02	
122,690	1,000	.0679	.....	—.01	.02	
12,269	100	.....	—.0015	0.	0.	
134,959	1,100	.0755	.....	—.01	.02	
147,228	1,200	.0840	.....	—.01	.02	
159,497	1,300	.0919	.....	—.01	.02	
171,766	1,400	.1000	.....	—.01	.02	
184,035	1,500	.1082	.....	—.01	.02	
196,304	1,600	.1116	.....	—.01	.02	
208,573	1,700	.1248	.....	—.01	.01	
220,842	1,800	.1332	.....	—.01	.01	
233,111	1,900	.1414	.....	—.01	0.	
245,380	2,000	.1497	.....	—.02	0.	$E = 1,875,000$ pounds per square inch.
12,269	100	.....	—.0022	0.	.02	
257,649	2,100	.1585	.....	—.02	0.	
269,918	2,200	.1665	.....	—.02	0.	
282,187	2,300	.1741	.....	—.03	0.	
294,456	2,400	.1826	.....	—.03	0.	
306,725	2,500	.1914	.....	—.03	0.	
318,994	2,600	.2008	.....	—.04	—.01	
331,263	2,700	.2094	.....	—.04	—.01	
343,532	2,800	.2181	.....	—.04	—.01	
355,801	2,900	.2271	.....	—.05	—.01	
368,070	3,000	.2367	.....	—.05	—.01	
12,269	100	.....	.0004	0.	+.02	
380,339	3,100	.2460	.....	—.06	—.02	
392,608	3,200	.2586	.....	—.06	—.03	
404,877	3,300	.2721	.....	—.06	—.03	
417,146	3,400	.2885	.....	—.06	—.05	
429,415	3,500	.3100	.....	—.06	—.07	Ultimate strength.
.....	3,500	.3227	.....	.....	.....	After 2 minutes.
.....	3,500	.3260	.....	—.06	—.10	After 4 minutes.

Failed by crushing the fibers along the post from 4" to 24" from the end.

No. 1406.

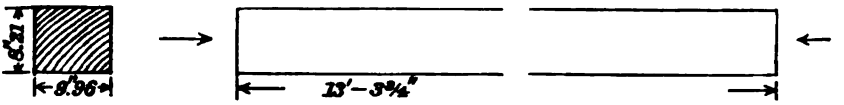


Marks, No. 3.
Weight, 395 pounds=33.4 pounds per cubic foot.
Specific gravity, .5344.
Rate of growth, 11 rings per inch.
Sectional area, 102.2 square inches.
Gauged length, 150″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
10,220	100	0.	0.	0.	0.	Initial load.
20,440	200	.0085	.....	0.	0.	
30,660	300	.0171	.....	0.	0.	
40,880	400	.0262	.....	0.	0.	
51,100	500	.0350	.....	0.	0.	
61,320	600	.0444	.....	0.	0.	
71,540	700	.0534	.....	.01	0.	
81,760	800	.0629	.....	.01	0.	
91,980	900	.0719	.....	.01	0.	
102,200	1,000	.0814	.....	.01	0.	
10,220	100	.....	.0001	0.	0.	
112,420	1,100	.0903	.....	.01	0.	
122,640	1,200	.0999	.....	.01	0.	
132,860	1,300	.1091	.....	.01	0.	
143,080	1,400	.1183	.....	.02	0.	
153,300	1,500	.1276	.....	.02	0.	
163,520	1,600	.1377	.....	.02	0.	
173,740	1,700	.1467	.....	.02	0.	
183,960	1,800	.1563	.....	.02	0.	
194,180	1,900	.1660	.....	.03	0.	
204,400	2,000	.1755	.....	.04	—.01	E=1,639,000 pounds per square inch.
10,220	100	.....	.0017	0.	0.	
.....	100	.....	.0032	+.01	0.	Rested 16 hours.
214,620	2,100	.1900	.....	.05	0.	
224,840	2,200	.2005	.....	.05	—.01	
235,060	2,300	.2101	.....	.06	—.01	
245,280	2,400	.2202	.....	.06	—.01	
255,500	2,500	.2299	.....	.06	0.	
265,720	2,600	.2413	.....	.07	—.01	
275,940	2,700	.2511	.....	.07	—.01	
286,160	2,800	.2625	.....	.07	—.02	
296,380	2,900	.2724	.....	.08	—.02	
306,600	3,000	.2841	.....	.08	—.02	
10,220	100	.....	.0115	.02	0.	
316,820	3,100	.2980	.....	.08	—.03	
327,040	3,200	.3104	.....	.08	—.04	
337,260	3,300	.3279	.....	.09	—.06	
347,480	3,400	.3490	.....	.09	—.09	
357,700	3,500	.3760	.....	.09	—.11	
367,920	3,600	.4180	.....	.09	—.16	
378,140	3,700	.4680	.....	.09	—.30	Ultimate strength.

Failed by triple flexure. Fibers crushed near middle of length of post.

No. 1407.

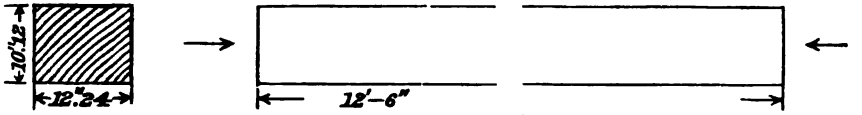


Marks, No. 6.
Weight, 260 pounds=34.3 pounds per cubic foot.
Specific gravity, .5488.
Rate of growth, 12 rings per inch.
Sectional area, 81.77 square inches.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
8,177	100	0.	0.	0.	0.	Initial load.
16,354	200	.0050	.....	0.	0.	
24,531	300	.0100	.....	0.	0.	
32,708	400	.0153	.....	0.	0.	
40,885	500	.0209	.....	0.	0.	
49,062	600	.0262	.....	0.	0.	
57,239	700	.0321	.....	0.	0.	
65,416	800	.0379	.....	0.	.01	
73,593	900	.0434	.....	0.	.01	
81,770	1,000	.0494	.....	0.	.01	
8,177	100	.....	—.0008	0.	0.	
89,947	1,100	.0548	.....	0.	.01	
98,124	1,200	.0608	.....	0.	.02	
106,301	1,300	.0666	.....	0.	.02	
114,478	1,400	.0722	.....	0.	.02	
122,655	1,500	.0780	.....	0.	.02	
130,832	1,600	.0841	.....	0.	.02	
139,009	1,700	.0902	.....	0.	.02	
147,186	1,800	.0960	.....	0.	.02	
155,363	1,900	.1020	.....	0.	.02	
163,540	2,000	.1080	.....	0.	.02	R.=1,756,000 pounds per square inch.
8,177	100	.....	—.0002	0.	0.	
171,717	2,100	.1131	.....	0.	.02	
179,894	2,200	.1195	.....	0.	.02	
188,071	2,300	.1256	.....	0.	.02	
196,248	2,400	.1318	.....	0.	.03	
204,425	2,500	.1387	.....	0.	.03	
212,602	2,600	.1450	.....	0.	.03	
220,779	2,700	.1523	.....	0.	.03	
228,956	2,800	.1587	.....	.01	.03	
237,133	2,900	.1656	.....	.01	.03	
245,310	3,000	.1726	.....	.01	.03	
204,425	2,500	.1442	.....	.....	.....	
163,540	2,000	.1145	.....	.....	.....	
122,655	1,500	.0850	.....	.....	.....	
81,770	1,000	.0551	.....	.....	.....	
40,885	500	.0250	.....	.....	.....	
8,177	100	.....	.0024	0.	0.	
40,885	500	.0240	.....	.....	.....	
81,770	1,000	.0530	.....	.....	.....	
122,655	1,500	.0824	.....	.....	.....	
.....	2,000	.1123	.....	.....	.....	
.....	2,500	.1426	.....	.....	.....	
.....	3,000	.1720	.....	.01	.03	
.....	3,000	.1740	.....	.....	.....	After 1 minute.
253,487	3,100	.1836	.....	.01	.03	
261,664	3,200	.1926	.....	.01	.03	
269,841	3,300	.2040	.....	.03	.02	
278,018	3,400	.....	.....	.06	.01	
286,195	3,500	.....	.....	.08	.01	
294,372	3,600	.....	.....	.09	—.03	Ultimate strength.

Fibers crushed 3″ from end of the post at a place where the grain of the wood was wavy.

No. 1408.

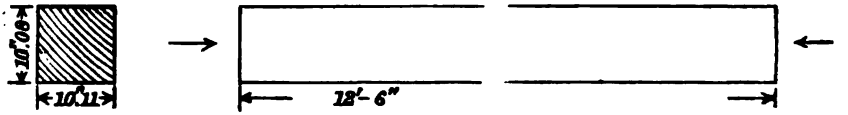


Marks, No. 8.
Weight, 396 pounds = 36.8 pounds per cubic foot.
Specific gravity, .5888.
Rate of growth, 11 rings per inch.
Sectional area, 123.87 square inches.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
12,387	100	0.	0.	0.	0.	Initial load.
24,774	200	.0035	.....	0.	0.	
37,161	300	.0076	.....	0.	0.	
49,548	400	.0128	.....	0.	0.	
61,935	500	.0179	.....	0.	0.	
74,322	600	.0231	.....	0.	.01	
86,709	700	.0286	.....	0.	.01	
99,096	800	.0340	.....	0.	.01	
111,483	900	.0396	.....	0.	.01	
123,870	1,000	.0450	.....	0.	.01	
12,387	100	.....	—.0020	0.	0.	
136,257	1,100	.0500	.....	0.	.01	
148,644	1,200	.0559	.....	0.	.01	
161,031	1,300	.0615	.....	0.	.01	
173,418	1,400	.0674	.....	0.	.01	
185,805	1,500	.0729	.....	0.	.01	
198,192	1,600	.0790	.....	0	.01	
210,579	1,700	.0849	.....	0.	.01	
222,966	1,800	.0908	.....	0.	.01	
235,353	1,900	.0965	.....	0.	.01	
247,740	2,000	.1020	.....	0.	.01	E=1,854,000 pounds per square inch.
12,387	100	.....	—.0005	0.	0.	
260,127	2,100	.1072	.....	0.	.01	
272,514	2,200	.1136	.....	0.	.01	
284,901	2,300	.1192	.....	0.	.01	
297,288	2,400	.1251	.....	0.	.01	
309,675	2,500	.1311	.....	0.	.01	
322,062	2,600	.1380	.....	0.	.01	
334,449	2,700	.1438	.....	0.	.01	
346,836	2,800	.1496	.....	0.	.01	
359,223	2,900	.1559	.....	0.	.01	
371,610	3,000	.1626	.....	0.	.01	
12,387	100	.....	.0015	0.	0.	
383,997	3,100	.1673	.....	—.01	0.	
396,384	3,200	.1755	.....	—.01	0.	
408,771	3,300	.1837	.....	—.01	0.	
421,158	3,400	.1914	.....	—.01	0.	
433,545	3,500	.2005	.....	—.01	0.	
445,932	3,600	.2107	.....	—.01	0.	
458,319	3,700	.2203	.....	—.01	0.	
470,706	3,800	.2390	.....	0.	0.	
.....	3,800	.2440	.....	.....	.....	After 1 minute.
.....	3,800	.2480	.....	.....	.....	After 2 minutes.
.....	3,800	.2565	.....	0.	0.	After 5 minutes.
483,093	3,900	.2701	.....	+.01	0.	Ultimate strength.
.....	3,900	.2825	.....	.02	0.	After 2 minutes.
.....	3,900	.2944	.....	.06	+.05	After 4 minutes.

Fibers began to crush at middle of post.

No. 1409.



Marks, No. 16.
Weight, 292 pounds=33 pounds per cubic foot.
Specific gravity, .5280.
Rate of growth, 10 rings per inch.
Sectional area, 101.91 square inches.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged lengths.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
10,191	100	0.	0.	0.	0.	Initial load.
20,382	200	.0070	.....	0.	0.	
30,573	300	.0142	.....	0.	0.	
40,764	400	.0210	.....	0.	0.	
50,955	500	.0284	.....	0.	0.	
61,146	600	.0354	.....	0.	0.	
71,337	700	.0427	.....	0.	0.	
81,528	800	.0498	.....	0.	0.	
91,719	900	.0570	.....	0.	0.	
101,910	1,000	.0644	.....	0.	0.	
10,191	100	.....	.0007	0.	0.	
112,101	1,100	.0710	.....	0.	0.	
122,292	1,200	.0787	.....	0.	0.	
132,483	1,300	.0864	.....	0.	0.	
143,674	1,400	.0935	.....	0.	0.	
152,865	1,500	.1009	.....	0.	0.	
163,056	1,600	.1082	.....	0.	0.	
173,247	1,700	.1157	.....	0.	0.	
183,438	1,800	.1231	.....	0.	0.	
193,629	1,900	.1308	.....	0.	0.	
203,820	2,000	.1384	.....	0.	0.	E=1,398,000 pounds per square inch.
10,191	100	.....	.0020	0.	0.	
214,011	2,100	.1449	.....	0.	0.	
224,202	2,200	.1525	.....	0.	0.	
234,393	2,300	.1602	.....	0.	0.	
244,584	2,400	.1680	.....	0.	0.	
254,775	2,500	.1755	.....	0.	0.	
264,966	2,600	.1834	.....	0.	0.	
275,157	2,700	.1914	.....	0.	0.	
285,348	2,800	.1990	.....	0.	0.	
295,539	2,900	.2076	.....	0.	0.	
305,730	3,000	.2175	.....	0.	0.	
10,191	100	.....	.0060	0.	0.	
203,820	2,000	.1427	.....	.01	0.	Rested 16 hours, during which time the load fell to 190,300 pounds.
190,300	1,867	.1419	.....	.01	0.	
203,820	2,000	.1515	.....	.01	0.	
10,191	100	.....	.0135	0.	0.	
101,910	1,000	.0766	.....	.....	.....	
203,820	2,000	.1500	.....	.....	.....	
305,730	3,000	.2255	.....	.01	0.	
.....	3,000	.2285	.....	.....	.....	After 1 minute.
203,820	2,000	.1571	.....	.....	.....	
101,910	1,000	.0830	.....	.....	.....	
10,191	100	.....	.0158	0.	0.	
101,910	1,000	.0795	.....	.....	.....	
203,820	2,000	.1539	.....	.....	.....	
305,730	3,000	.2315	.....	.....	.....	
315,921	3,100	.2464	.....	.01	0.	
326,112	3,200	.2712	.....	.01	0.	
336,303	3,300	.3040	.....	.01	0.	
.....	3,400	.3610	.....	0.	—.04	Ultimate strength.
.....	3,400	.4170	.....	0.	—.10	After 3 minutes.

Fibers crushed near middle of length of post.

BRICKS FROM THE NEW ENGLAND STEAM BRICK COMPANY, POVIDENCE, R. I.—Continued.

[Works at Barrington and Nayatt, R. I.]

HARD BODY BRICK FROM YARD NO. 2.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
339	6.00	3.68	2.42	3,386	1,414	

SMOOTH-CUT PAVING BRICK.

340	6.00	3.68	2.35	4,595	2,233	

PAVING BRICK.

341	6.00	3.75	2.36	3,790	1,633	
342	6.00	3.72	2.39	3,398	1,440	

BRICKS FROM THE SAYRE & FISHER COMPANY, SAYREVILLE, N. J.

LIGHT CHOCOLATE COLOR, NO. 71.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
352	6.00	3.96	2.28	2,405	1,051	

BUFF SPECKLED, No. 27.

353	10.00	4.04	1.53	829	1,315	12″ brick.

BUFF SPECKLED, No. 33.

354	10.00	4.00	1.50	1,106	1,843	12″ brick.

PAVING BRICK FROM GRANT BRICK COMPANY, FRANKLIN, PA.

No. of test.	Distance between end supports.	Dimensions.		Ultimate strength.		Remarks.
		Breadth.	Depth.	Total.	Modulus of rupture, R.	
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	
366	6.00	4.09	2.41	6,835	2,589	

Lateral expansion determinations under endwise compression loads. Gauged length, 7″, taken 18″ from south end of the post.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
8,048	100	0.	0.	.....	.....	
80,480	1,000	.0015	.....	.....	.....	
160,960	2,000	.0031	.....	.....	.....	
241,440	3,000	.0053	.....	.....	.....	
160,960	2,000	.0035	.....	.....	.....	
80,480	1,000	.0016	.....	.....	.....	
8,048	100	.....	.0001	.....	.....	

Gauged length, 7″ at middle of length of post.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
8,048	100	0.	0.	.....	.....	Initial load.
80,480	1,000	.0007	.....	.....	.....	
160,960	2,000	.0016	.....	.....	.....	
241,440	3,000	.0024	.....	.....	.....	
8,048	100	.....	.0001	.....	.....	

Gauged length, 7″ taken 18″ from north end of post.

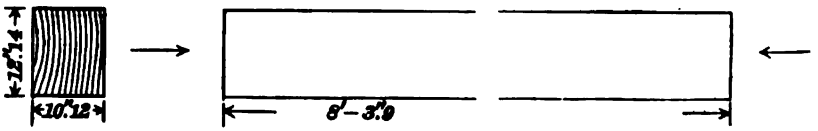
Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
8,048	100	0.	0.	.....	.....	Initial load.
80,480	1,000	.0006	.....	.....	.....	
160,960	2,000	.0014	.....	.....	.....	
241,440	3,000	.0032	.....	.....	.....	
160,960	2,000	.0014	.....	.....	.....	
80,480	1,000	.0006	.....	.....	.....	
8,048	100	.....	—.0001	.....	.....	

Gauged length, 7″ taken 3 feet from south end of post.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
8,048	100	0.	0.	.....	.....	Initial load.
80,480	1,000	.0005	.....	.....	.....	
160,960	2,000	.0012	.....	.....	.....	
241,440	3,000	.0024	.....	.....	.....	
160,960	2,000	.0010	.....	.....	.....	
80,480	1,000	.0003	.....	.....	.....	
8,048	100	.....	—.0001	.....	.....	
342,000	4,249	.....	.....	.....	.....	Ultimate strength.

Fibers crushed 12″ from the north end in an oblique direction across the stick.

No. 1411.



Marks, No. 8.
Weight, 246 pounds=34.6 pounds per cubic foot.
Specific gravity, .5536.
Rate of growth, 11 rings per inch.
Sectional area, 122.86 square inches.
Gauged length, 50".
Not counterweighted.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
12,286	100	0.	0.	0.	0.	Initial load.
24,572	200	.0030	.....	0.	0.	
36,858	300	.0061	.....	0.	0.	
49,144	400	.0091	.....	0.	0.	
61,430	500	.0120	.....	0.	0.	
73,716	600	.0149	.....	0.	0.	
86,002	700	.0179	.....	0.	0.	
98,288	800	.0208	.....	0.	0.	
110,574	900	.0236	.....	0.	0.	
122,860	1,000	.0264	.....	0.	0.	
12,286	100	.....	.0007	0.	0.	
122,860	1,000	.0266	.....	.....	.....	
.....	1,000	.0284	.....	.....	.....	After sustaining load 16 hours.
12,286	100	.....	.0026	.....	.....	
122,860	1,000	.0280	.....	0.	0.	
135,146	1,100	.0309	.....	0.	0.	
147,432	1,200	.0338	.....	0.	0.	
159,718	1,300	.0367	.....	0.	0.	
172,004	1,400	.0395	.....	0.	0.	
184,290	1,500	.0424	.....	0.	0.	
196,576	1,600	.0453	.....	0.	0.	
208,862	1,700	.0483	.....	0.	0.	
221,148	1,800	.0509	.....	0.	0.	
233,434	1,900	.0539	.....	0.	0.	
245,720	2,000	.0569	.....	0.	0.	R=1,743,000 pounds per square inch.
12,286	100	.....	.0024	0.	0.	
258,006	2,100	.0595	.....	0.	0.	
270,292	2,200	.0626	.....	0.	0.	
282,578	2,300	.0655	.....	0.	0.	
294,864	2,400	.0683	.....	0.	0.	
307,150	2,500	.0714	.....	0.	0.	
319,436	2,600	.0743	.....	0.	0.	
331,722	2,700	.0772	.....	0.	0.	
344,008	2,800	.0804	.....	0.	0.	
356,294	2,900	.0836	.....	0.	0.	
368,580	3,000	.0866	.....	0.	0.	
245,720	2,000	.0584	.....	.....	.....	
122,860	1,000	.0301	.....	.....	.....	
12,286	100	.....	.0034	.....	.....	
122,860	1,000	.0290	.....	.....	.....	
245,720	2,000	.0576	.....	.....	.....	
368,580	3,000	.0868	.....	.....	.....	
380,866	3,100	.0896	.....	0.	0.	
393,152	3,200	.0936	.....	0.	0.	
405,438	3,300	.0960	.....	0.	0.	
417,724	3,400	.1011	.....	0.	0.	
430,010	3,500	.1055	.....	0.	0.	
368,580	3,000	.0923	.....	.....	.....	
307,150	2,500	.0780	.....	.....	.....	
245,720	2,000	.0635	.....	.....	.....	
184,290	1,500	.0489	.....	.....	.....	
122,860	1,000	.0341	.....	.....	.....	
12,286	100	.....	.0058	.....	.....	

Lateral expansion determinations under endwise compression loads. Gauged length, 9″, taken at middle of length of post.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
12, 286	100	0.	0.	.....	.....	Initial load.
122, 860	1, 000	.0019	.....	.....	.....	
245, 720	2, 000	.0040	.....	.....	.....	
368, 580	3, 000	.0061	.....	.....	.....	
430, 010	3, 500	.0072	.....	.....	.....	
368, 580	3, 000	.0063	.....	.....	.....	
245, 720	2, 000	.0044	.....	.....	.....	
122, 860	1, 000	.0024	.....	.....	.....	
12, 286	100	.....	.0005	.....	.....	
122, 860	1, 000	.0023	.....	.....	.....	
245, 720	2, 000	.0043	.....	.....	.....	
368, 580	3, 000	.0063	.....	.....	.....	
430, 010	3, 500	.0074	.....	.....	.....	
368, 580	3, 000	.0065	.....	.....	.....	
245, 720	2, 000	.0047	.....	.....	.....	
122, 860	1, 000	.0027	.....	.....	.....	
12, 286	100	.....	.0007	.....	.....	
122, 860	1, 000	.0026	.....	.....	.....	
245, 720	2, 000	.0045	.....	.....	.....	
368, 580	3, 000	.0066	.....	.....	.....	
245, 720	2, 000	.0047	.....	.....	.....	
122, 860	1, 000	.0028	.....	.....	.....	
•12, 286	100	.....	.0009	.....	.....	
368, 580	3, 000	.0067	.....	.....	.....	
12, 286	100	.....	.0009+	.....	.....	

Gauged length 9″, taken 21″ from south end of post over a section of the wood having a wavy grain.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
12, 286	100	0.	0.	.....	.....	Initial load.
122, 860	1, 000	.0022	.....	.....	.....	
245, 720	2, 000	.0046	.....	.....	.....	
368, 580	3, 000	.0071	.....	.....	.....	
430, 010	3, 500	.0083	.....	.....	.....	
368, 580	3, 000	.0073	.....	.....	.....	
245, 720	2, 000	.0050	.....	.....	.....	
122, 860	1, 000	.0026	.....	.....	.....	
12, 286	100	.....	0.	.....	.....	

Gauged length, 9″, taken 18″ from north end of post.

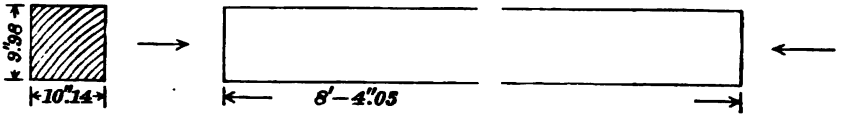
Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
12,286	100	0.	0.	.....	.....	Initial load.
122,860	1,000	.0018	.....	.....	.....	
245,720	2,000	.0038	.....	.....	.....	
368,580	3,000	.0057	.....	.....	.....	
430,010	3,500	.0066	.....	.....	.....	
368,580	3,000	.0058	.....	.....	.....	
245,720	2,000	.0038	.....	.....	.....	
122,860	1,000	.0017	.....	.....	.....	
12,286	100	.....	—.0001	.....	.....	

Gauged length, 9″, taken 4″ from north end of post.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
12,286	100	0.	0.	.....	.....	Initial load.
122,860	1,000	.0028	.....	.....	.....	
245,720	2,000	.0053	.....	.....	.....	
368,580	3,000	.0074	.....	.....	.....	
430,010	3,500	.0086	.....	.....	.....	
368,580	3,000	.0076	.....	.....	.....	
245,720	2,000	.0055	.....	.....	.....	
122,860	1,000	.0030	.....	.....	.....	
12,286	100	.....	.0001	.....	.....	
529,800	4,312	.....	.....	.....	.....	Ultimate strength.

Fibers crushed 21″ from south end of post at a section containing wavy grain.

No. 1412.

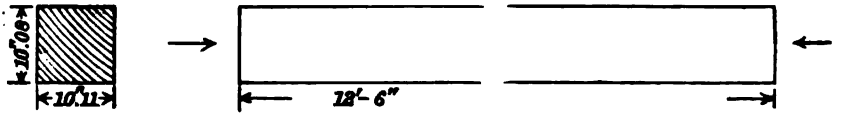


Marks, No. 3.
Weight, 198 pounds=33.8 pounds per cubic foot.
Specific gravity, .5408.
Rate of growth, 11 rings per inch.
Sectional area, 101.2 square inches.
Gauged length, 50".
Not counterweighted.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
10,120	100	0.	0.	0.	0.	Initial load.
20,240	200	.0025	.....	0.	0.	
30,360	300	.0055	.....	0.	0.	
40,480	400	.0083	.....	0.	0.	
60,600	500	.0112	.....	0.	0.	
60,720	600	.0141	.....	0.	0.	
70,840	700	.0169	.....	0.	0.	
80,960	800	.0196	.....	0.	0.	
91,080	900	.0224	.....	0.	0.	
101,200	1,000	.0251	.....	0.	0.	
10,120	100	.....	.0003	0.	0.	
121,440	1,200	.0306	.....	0.	0.	
141,680	1,400	.0364	.....	0.	0.	
161,920	1,600	.0422	.....	0.	0.	
182,160	1,800	.0478	.....	0.	0.	
202,400	2,000	.0535	.....	0.	0.	E=1,792,000 pounds per square inch.
10,120	100	.....	.0005	0.	0.	
222,640	2,200	.0594	.....	0.	0.	
242,880	2,400	.0655	.....	0.	0.	
263,120	2,600	.0714	.....	0.	0.	
283,360	2,800	.0774	.....	0.	0.	
303,600	3,000	.0838	.....	0.	0.	
10,120	100	.....	.0014	0.	0.	
323,840	3,200	.0904	.....	0.	0.	
344,080	3,400	.0981	.....	0.	0.	
364,320	3,600	.1099	.....	0.	—.01	
384,560	3,800	.1250	.....	0.	—.01	
391,900	3,872	.1369	.....	0.	—.03	
10,120	100	.....	.0143	0.	0.	
418,800	4,138	.....	.....	.....	.....	Ultimate strength.

Fibers crushed 14" from end of post at a place where the direction of the grain was oblique.

No. 1409.

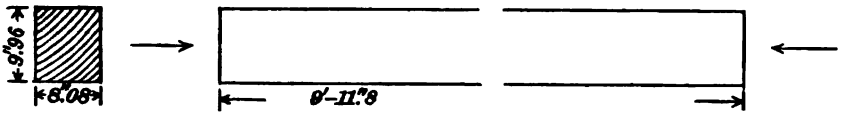


Marks, No. 16.
Weight, 292 pounds=33 pounds per cubic foot.
Specific gravity, .5280.
Rate of growth, 10 rings per inch.
Sectional area, 101.91 square inches.
Gauged length, 100".
Counterweighted at middle.

Applied loads.		In gauged lengths.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
10,191	100	0.	0.	0.	0.	Initial load
20,382	200	.0070	.....	0.	0.	
30,573	300	.0142	.....	0.	0.	
40,764	400	.0210	.....	0.	0.	
50,955	500	.0284	.....	0.	0.	
61,146	600	.0354	.....	0.	0.	
71,337	700	.0427	.....	0.	0.	
81,528	800	.0498	.....	0.	0.	
91,719	900	.0570	.....	0.	0.	
101,910	1,000	.0644	.....	0.	0.	
10,191	100	.....	.0007	0.	0.	
112,101	1,100	.0710	.....	0.	0.	
122,292	1,200	.0787	.....	0.	0.	
132,483	1,300	.0864	.....	0.	0.	
143,674	1,400	.0935	.....	0.	0.	
152,865	1,500	.1009	.....	0.	0.	
163,056	1,600	.1082	.....	0.	0.	
173,247	1,700	.1157	.....	0.	0.	
183,438	1,800	.1231	.....	0.	0.	
193,629	1,900	.1308	.....	0.	0.	
203,820	2,000	.1384	.....	0.	0.	E=1,398,000 pounds per square inch.
10,191	100	.....	.0020	0.	0.	
214,011	2,100	.1449	.....	0.	0.	
224,202	2,200	.1525	.....	0.	0.	
234,393	2,300	.1602	.....	0.	0.	
244,584	2,400	.1680	.....	0.	0.	
254,775	2,500	.1755	.....	0.	0.	
264,966	2,600	.1834	.....	0.	0.	
275,157	2,700	.1914	.....	0.	0.	
285,348	2,800	.1990	.....	0.	0.	
295,539	2,900	.2076	.....	0.	0.	
305,730	3,000	.2175	.....	0.	0.	
10,191	100	.....	.0060	0.	0.	
203,820	2,000	.1427	.....	.01	0.	Rested 16 hours, during which time the load fell to 190,300 pounds.
190,300	1,867	.1419	.....	.01	0.	
203,820	2,000	.1515	.....	.01	0.	
10,191	100	.....	.0135	0.	0.	
101,910	1,000	.0766	.....	.....	.....	
203,820	2,000	.1500	.....	.....	.....	
305,730	3,000	.2255	.....	.01	0.	
.....	3,000	.2285	.....	.....	.....	After 1 minute.
203,820	2,000	.1571	.....	.....	.....	
101,910	1,000	.0830	.....	.....	.....	
10,191	100	.....	.0158	0.	0.	
101,910	1,000	.0796	.....	.....	.....	
203,820	2,000	.1539	.....	.....	.....	
305,730	3,000	.2315	.....	.....	.....	
315,921	3,100	.2464	.....	.01	0.	
326,112	3,200	.2712	.....	.01	0.	
336,303	3,300	.3040	.....	.01	0.	
.....	3,400	.3610	.....	0.	—.04	Ultimate strength.
.....	3,400	.4170	.....	0.	—.10	After 3 minutes.

Fibers crushed near middle of length of post.

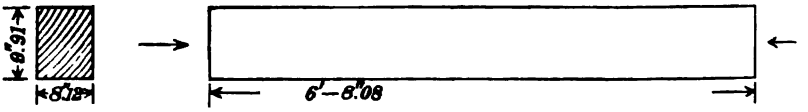
No. 1410.



Marks, No. 6.
Weight, 176 pounds=31.5 pounds per cubic foot.
Specific gravity, .5040.
Rate of growth, 12 rings per inch.
Sectional area, 80.48 square inches.
Ganged length, 100″.
Not counterweighted.

Applied loads.		In ganged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
8,048	100	0.	0.	0.	0.	Initial load.
16,096	200	.0050	.....	0.	0.	
24,144	300	.0103	.....	0.	0.	
32,192	400	.0159	.....	0.	0.	
40,240	500	.0214	.....	0.	0.	
48,288	600	.0268	.....	0.	0.	
56,336	700	.0323	.....	0.	0.	
64,384	800	.0380	.....	0.	0.	
72,432	900	.0435	.....	0.	0.	
80,480	1,000	.0490	.....	0.	0.	
8,048	100	.....	—.0006	0.	0.	
88,528	1,100	.0542	.....	0.	0.	
96,576	1,200	.0601	.....	0.	0.	
104,624	1,300	.0657	.....	0.	0.	
112,672	1,400	.0715	.....	0.	0.	
120,720	1,500	.0777	.....	0.	0.	
128,768	1,600	.0834	.....	0.	.01	
136,816	1,700	.0890	.....	0.	.01	
144,864	1,800	.0947	.....	0.	.01	
152,912	1,900	.1002	.....	0.	.01	
160,960	2,000	.1063	.....	0.	.01	E=1,791,000 pounds per square inch.
8,048	100	.....	+.0002	0.	0.	
169,208	2,100	.1110	.....	0.	.01	
177,056	2,200	.1171	.....	0.	.01	
185,104	2,300	.1233	.....	0.	.01	
193,152	2,400	.1294	.....	0.	.01	
201,200	2,500	.1354	.....	0.	.01	
209,248	2,600	.1415	.....	0.	.01	
217,296	2,700	.1474	.....	0.	.01	
225,344	2,800	.1534	.....	0.	.01	
233,392	2,900	.1598	.....	0.	.01	
241,440	3,000	.1660	.....	0.	.01	
201,200	2,500	.1383	.....	.....	.....	
160,960	2,000	.1098	.....	.....	.....	
120,720	1,500	.0813	.....	.....	.....	
80,480	1,000	.0526	.....	.....	.....	
40,240	500	.0240	.....	.....	.....	
8,048	100	.....	.0015	.....	.....	
40,240	500	.0230	.....	.....	.....	
80,480	1,000	.0511	.....	.....	.....	
120,720	1,500	.0792	.....	.....	.....	
160,960	2,000	.1079	.....	.....	.....	
201,200	2,500	.1370	.....	.....	.....	
241,440	3,000	.1664	.....	.....	.....	
3,000	3,000	.1759	.....	0.	.01	After sustaining load 1 hour.
201,200	2,500	.1477	.....	.....	.....	
160,960	2,000	.1191	.....	.....	.....	
120,720	1,500	.0905	.....	.....	.....	
80,480	1,000	.0611	.....	.....	.....	
40,240	500	.0312	.....	.....	.....	
8,048	100	.....	.0079	.....	.....	

No. 1414.

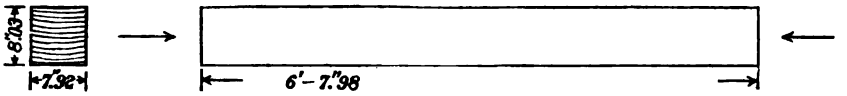


Marks, No. 5.
Weight, 114 pounds=30.6 pounds per cubic foot.
Specific gravity, .4896.
Rate of growth, 12 rings per inch.
Sectional area, 80.47 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
8,047	100	0.	0.	0.	0.	Initial load.
16,094	200	.0020	.....	.....	.....	
32,188	400	.0070	.....	.....	.....	
48,282	600	.0121	.....	.....	.....	
64,376	800	.0174	.....	.....	.....	
80,470	1,000	.0223	.....	.....	.....	
8,047	100	.....	0.	.....	.....	
96,564	1,200	.0276	.....	.....	.....	
112,658	1,400	.0331	.....	.....	.....	
.....	1,400	.0338	.....	.....	.....	After one-half hour.
128,752	1,600	.0394	.....	.....	.....	
144,846	1,800	.0448	.....	.....	.....	
160,940	2,000	.0499	.....	.....	.....	E=1,904,000 pounds per square inch.
177,034	2,200	.0553	.....	.....	.....	
193,128	2,400	.0609	.....	.....	.....	
209,222	2,600	.0665	.....	.....	.....	
225,316	2,800	.0719	.....	.....	.....	
241,410	3,000	.0775	.....	.....	.....	
8,047	100	.....	.0018	.....	.....	
257,504	3,200	.0832	.....	.....	.....	
273,598	3,400	.0890	.....	.....	.....	
289,692	3,600	.0953	.....	.....	.....	
305,786	3,800	.1024	.....	.....	.....	
321,880	4,000	.1098	.....	.....	.....	
8,047	100	.....	.0044	.....	.....	
329,927	4,100	.1154	.....	.....	.....	
337,974	4,200	.1199	.....	.....	.....	
346,021	4,300	.1250	.....	.....	.....	
354,068	4,400	.1309	.....	.....	.....	
362,115	4,500	.1378	.....	.....	.....	
8,047	100	.....	.0125	.....	.....	
370,162	4,600	.1470	.....	.....	.....	Ultimate strength.

Fibers crushed 10″ from end of post.

No. 1415.

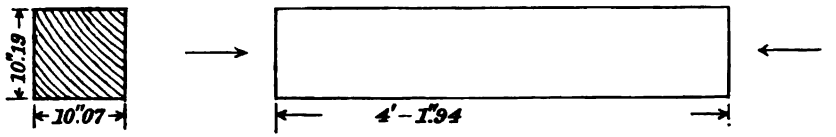


Marks, No. 32.
Weight, 99 pounds=33.6 pounds per cubic foot.
Specific gravity, .5376.
Rate of growth, 12 rings per inch.
Sectional area, 63.6 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
6,360	100	0.	0.	.....	.....	Initial load
12,720	200	.0034	.....	.....	.....	
25,440	400	.0090	.....	.....	.....	
38,160	600	.0160	.....	.....	.....	
50,880	800	.0220	.....	.....	.....	
63,600	1,000	.0280	.....	.....	.....	
6,360	100	.....	.0008	.....	.....	
76,320	1,200	.0341	.....	.....	.....	
89,040	1,400	.0399	.....	.....	.....	
101,760	1,600	.0459	.....	.....	.....	
114,480	1,800	.0515	.....	.....	.....	
127,200	2,000	.0578	.....	.....	.....	E=1,675,000 pounds per square inch.
6,360	100	.....	.0011	.....	.....	
139,920	2,200	.0624	.....	.....	.....	
152,640	2,400	.0694	.....	.....	.....	
165,360	2,600	.0754	.....	.....	.....	
178,080	2,800	.0815	.....	.....	.....	
190,800	3,000	.0883	.....	.....	.....	
6,360	100	.....	.0026	.....	.....	
203,520	3,200	.0942	.....	.....	.....	
216,240	3,400	.1008	.....	.....	.....	
228,960	3,600	.1090	.....	.....	.....	
241,680	3,800	.1166	.....	.....	.....	
254,400	4,000	.1272	.....	.....	.....	
6,360	100	.....	.0085	.....	.....	
260,760	4,100	.1333	.....	.....	.....	
267,120	4,200	.1401	.....	.....	.....	
273,480	4,300	.1515	.....	.....	.....	
279,840	4,400	.1608	.....	.....	.....	
286,200	4,500	.1836	.....	.....	.....	
292,560	4,600	.2075	.....	.....	.....	
294,200	4,626	.....	.....	.....	.....	Ultimate strength.

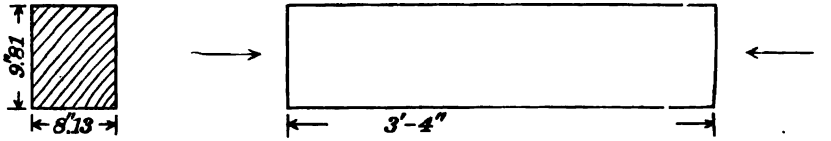
Fibers crushed near middle of length of post and 8″ from end. The wood opened along an oblique seasoning crack between the places where the fibers were crushed.

No. 1416.



Marks, No. 16.
Weight, 96 pounds=32.3 pounds per cubic foot.
Specific gravity, .5168.
Rate of growth, 10 rings per inch.
Sectional area, 102.6 square inches.
Ultimate strength, 409,200 pounds=3,988 pounds per square inch.
Fibers crushed along the middle part and 11″ from one end of the post.

No. 1417.



Marks, No. 6.
Weight, 57½ pounds=31.1 pounds per cubic foot.
Specific gravity, .4976.
Rate of growth, 12 rings per inch.
Sectional area, 79.75 square inches.
Ultimate strength, 375,200 pounds=4,705 pounds per square inch.
Fibers crushed 11″ from the end of the post.

DOUGLAS FIR.

TABULATION OF COMPRESSION TESTS.

No. of test.	Marks.	Age of tree.	Rings per inch.	Specific gravity.	Cross-section dimensions.		Sectional area.	Length.	Length in diameters.	Ultimate strength per square inch.	Modulus of elasticity, E.	Manner of failure.
					Width.	Thickness.						
		Years.			*Inches.*	*Inches.*	*Sq. in.*	*Ft. in.*		*Pounds.*	*Pounds.*	
1401	No. 1	450	12	.5216	10.06	8.12	81.68	26 ½	38.4	2,600	1,651,000	Triple flexure, and fibers crushed on compression side of bend 18″ from end.
1402	No. 9	375	12	.5896	12.00	10.12	121.44	25 0	29.6	3,700	1,875,000	Triple flexure.
1403	No. 4	400	10	.5520	10.18	10.04	102.20	25 0	29.9	2,700	1,785,000	Triple flexure, obliquely downward.
1404	No. 5	300	12	.5280	10.10	8.18	82.62	20 0	29.8	3,371	1,704,000	Triple flexure, horizontally and downward. Fibers crushed 3″ from middle of length.
1405	No. 2	300	15	.5376	12.10	10.14	122.69	16 8	19.7	3,500	1,875,000	Fibers crushed along the post from 4″ to 24″ from end.
1406	No. 3	450	11	.5344	10.06	10.16	102.2	16 8	19.9	3,700	1,639,000	Triple flexure. Fibers crushed near middle of length.
1407	No. 6	375	12	.5488	9.96	8.21	81.77	13 3¾	19.5	3,600	1,756,000	Fibers crushed 3″ from end of post where grain of wood was wavy.
1408	No. 8	450	11	.5888	12.24	10.12	123.87	12 6	14.8	3,900	1,854,000	Fibers began to crush at middle of post.
1409	No. 16	375	10	.5280	10.11	10.08	101.91	12 6	14.9	3,400	1,393,000	Fibers crushed at middle of length.
1410	No. 6	375	12	.5040	8.08	9.96	80.48	9 11.8	14.9	4,249	1,791,000	Fibers crushed 12″ from end in an oblique direction across the stick.
1411	No. 8	450	11	.5536	10.12	12.14	122.86	8 3.9	9.9	4,312	1,743,000	Fibers crushed 21″ from end of post at a section containing wavy grain.
1412	No. 3	450	11	.5408	10.14	9.98	101.2	8 4.05	10	4,138	1,792,000	Fibers crushed 14″ from end of post, where the direction of the grain was oblique.
1413	No. 2	300	15	.5376	10.07	12.05	121.34	6 8.13	8	4,100	1,963,000	Fibers crushed 10″ from end.
1414	No. 5	300	12	.4896	8.12	9.91	80.47	6 8.08	9.9	2,600	1,904,000	Do.
1415	No. 32	266	12	.5376	7.92	8.03	63.6	6 7.98	10.1	4,626	1,675,000	Fibers crushed near middle of length and 8″ from end. The wood opened along an oblique seasoning crack between the places where fibers were crushed.
1416	No. 16	375	10	.5168	10.07	10.19	102.6	4 1.94	5	3,988	.....	Fibers crushed along the middle and 11″ from one end.
1417	No. 6	375	12	.4976	8.13	9.81	79.75	3 4	4.1	4,705	.....	Fibers crushed 11″ from the end.

EXPANSION AND CONTRACTION OF OAK AND PINE WOOD.

OAK AND PINE WOOD.

Tests made with three samples each of well-seasoned red oak and white pine.

Of the red oak samples, No. 1 was observed approximately in a radial direction with reference to the growth of the tree—that is, the expansion and contraction were measured at right angles to the rings of growth.

In sample No. 2 the direction observed was approximately tangential or nearer parallel to the rings of growth. The rings were irregular in direction, hence the observations could not strictly show the relation of radial and tangential changes.

Sample No. 3 was taken lengthwise the grain.

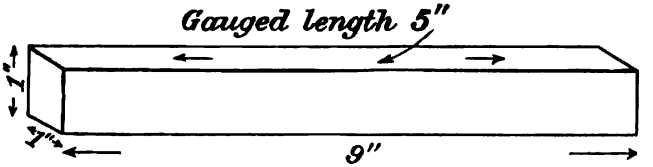
In the white pine samples, No. 1 was taken radially and No. 2 quartering with the grain, while No. 3 was a lengthwise specimen.

Gauged lengths of 5″ each were established on the two opposite sides of the specimens by means of tacks driven into the wood sidewise the grain.

In conjunction with the measurements of the samples they were also weighed; hence the results will indicate the amount of moisture absorbed during the time observations were carried on.

The samples were from well-seasoned stock which had been in store at Watertown arsenal.

Form of specimens.



Samples cut from sticks that had been seasoning in storehouse about 30 years.

DIMENSIONS AND WEIGHTS OF STICKS WHEN RECEIVED FROM CARPENTER'S SHOP.

WHITE PINE.

No. of sample.	Gauged length.			Weight.
	A.	B.	Mean.	
	Inches.	*Inches.*	*Inches.*	*Grams.*
1	5.0115	5.0010	5.0062	58.0
2	5.0012	4.9998	5.0005	59.9
3	5.0001	5.0071	5.0036	60.4

RED OAK.

1	4.9875	4.9881	4.9878	111.7
2	4.9895	4.9894	4.9894	108.8
3	4.9921	5.0090	5.0005	104.8

Samples exposed over night, 16 hours, in a damp, foggy atmosphere. They were under shelter of a board roof and rested on a wire screen.

WHITE PINE.

No. of sample.	Gauged length.					Weight.		
	A.	B.	Mean.	Total gain.	Total loss.	Total.	Total gain.	Total loss.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Grams.*	*Grams.*	*Grams.*
1	5.0439	5.0240	5.0339	.0277	.....	60.7	2.7	.....
2	5.0010	5.0023	5.0031	.0026	.....	61.3	1.4	.....
3	5.0007	5.0071	5.0039	.0003	.....	61.2	0.8	.....

RED OAK.

1	5.0075	5.0057	5.0066	.0188	.....	114.3	2.6	.....
2	5.0117	5.0084	5.0100	.0206	.....	111.5	2.7	.....
3	4.9944	5.0100	5.0022	.0017	.....	106.5	1.7	.....

Samples suspended over steam boiler 3½ hours in air at temperature of 125° F.

WHITE PINE.

No. of sample.	Gauged length.					Weight.		
	A.	B.	Mean.	Total gain.	Total loss.	Total.	Total gain.	Total loss.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Grams.*	*Grams.*	*Grams.*
1	4.9980	4.9872	4.9926	.....	.0136	56.1	.....	1.9
2	4.9995	4.9991	4.9993	.....	.0012	59.0	.....	0.9
3	4.9996	5.0068	5.0032	.....	.0004	59.8	.....	0.6

RED OAK.

1	4.9474	4.9543	4.9508	.....	.0370	109.4	.....	2.3
2	4.9484	4.9432	4.9458	.....	.0436	106.7	.....	2.1
3	4.9898	5.0081	4.9989	.....	.0016	103.5	.....	1.3

Samples exposed 4 hours in open air, cloudy weather, over box of thawing snow.

WHITE PINE.

No. of sample.	Gauged length.					Weight.		
	A.	B.	Mean.	Total gain.	Total loss.	Total.	Total gain.	Total loss.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Grams.*	*Grams.*	*Grams.*
1	5.0093	4.9999	5.0046	.....	.0016	57.4	.....	0.6
2	5.0002	4.9995	4.9998	.....	.0007	59.6	.....	0.3
3	4.9997	5.0067	5.0032	.....	.0004	60.2	.....	0.2

RED OAK.

1	4.9461	4.9534	4.9497	.....	.0381	110.3	.....	1.4
2	4.9475	4.9434	4.9454	.....	.0440	107.6	.....	1.2
3	4.9892	5.0086	4.9989	.....	.0016	104.1	.....	0.7

Samples exposed two nights and one day in the open air under shelter of a board roof. Temperature ranging from about 28° to 40° F. Clear weather prevailing.

WHITE PINE.

No. of sample.	Gauged length.					Weight.		
	A.	B.	Mean.	Total gain.	Total loss.	Total.	Total gain.	Total loss.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Grams.*	*Grams.*	*Grams.*
1	5.0232	5.0117	5.0174	.0112	.....	58.7	0.7	.....
2	5.0020	5.0011	5.0015	.0010	.....	60.2	0.3	.....
3	5.0003	5.0075	5.0039	.0003	.....	60.5	0.1	.....

RED OAK.

1	4.9612	4.9668	4.9640	.....	.0238	110.7	.....	1.0
2	4.9633	4.9610	4.9621	.....	.0273	109.0	0.2	.....
3	4.9898	5.0091	4.9994	.....	.0011	104.6	.....	0.2

Samples exposed 4 hours in steam-box.

WHITE PINE.

No. of sample.	Gauged length.					Weight.		
	A.	B.	Mean.	Total gain.	Total loss.	Total.	Total gain.	Total loss.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*	*Pounds.*
1	.....	.....	.....	.....	.....	76.7	18.7	.....
2	.....	.....	.....	.....	.....	73.5	13.6	.....
3	.....	.....	.....	.....	.....	70.5	10.1	.....

RED OAK.

1	.....	.....	.....	.....	.....	132.8	21.1	.....
2	.....	.....	.....	.....	.....	126.5	17.7	.....
3	.....	.....	.....	.....	.....	120.5	15.7	.....

Samples exposed 7 hours total in steam-box.

WHITE PINE.

No. of sample.	Gauged length.					Weight.		
	A.	B.	Mean.	Total gain.	Total loss.	Total.	Total gain.	Total loss.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Pounds.*	*Pounds.*	*Pounds.*
1	5.0588	5.0458	5.0523	.0461	.....	79.2	21.2	.....
2	5.0070	5.0055	5.0062	.0057	.....	76.0	16.1	.....
3	5.0017	5.0106	5.0061	.0025	.....	72.0	11.6	.....

RED OAK.

1	5.364	5.281	5.322	.334	.....	135.0	23.3	.....
2	5.336	5.446	5.391	.402	.....	130.7	21.9	.....
3	5.0158	5.0264	5.0211	.0206	.....	121.8	17.0	.....

Samples exposed 18 hours in dry air over steam boiler at temperature from 90° to 125° F.

WHITE PINE.

No. of sample.	Ganged length.					Weight.		
	A.	B.	Mean.	Total gain.	Total loss.	Total.	Total gain.	Total loss.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Grams.*	*Grams.*	*Grams.*
1	4.9563	4.9589	4.9576	.....	.0486	55.0	.....	3.0
2	4.9936	4.9920	4.9928	.....	.0077	57.2	.....	2.7
3	4.9985	5.0096	5.0040	.0004	.....	59.8	.....	0.6

RED OAK.

1	5.0067	4.9851	4.9859	.....	.0019	105.2	.....	6.5
2	5.0040	5.0078	5.0059	.0165	.....	103.3	.....	5.5
3	4.9905	5.0123	5.0014	.0009	.....	104.3	.....	0.5

Samples exposed out of doors, 1 foot above thawing ground, 6 hours. Fair weather.

WHITE PINE.

No. of sample.	Ganged length.					Weight.		
	A.	B.	Mean.	Total gain.	Total loss.	Total.	Total gain.	Total loss.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Grams.*	*Grams.*	*Grams.*
1	4.9667	4.9690	4.9678	.....	.0384	56.4	.....	1.6
2	4.9943	4.9919	4.9931	.....	.0074	57.9	.....	2.0
3	4.9984	5.0097	5.0040	.0004	.....	60.1	.....	0.3

RED OAK.

1	5.0027	4.9826	4.9826	.....	.0052	106.5	.....	5.2
2	5.0000	5.0031	5.0015	.0121	.....	104.3	.....	4.5
3	4.9893	5.0107	5.0000	.....	.0005	104.8	.....	0

Samples exposed out of doors, 1 foot above ground, over night, 16 hours. Fair weather; temperature, 30° F.

WHITE PINE.

No. of sample.	Ganged length.					Weight.		
	A.	B.	Mean.	Total gain.	Total loss.	Total.	Total gain.	Total loss.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Grams.*	*Gram.*	*Grams.*
1	4.9898	4.9917	4.9907	.....	.0155	58.5	0.5	.....
2	4.9963	4.9940	4.9951	.....	.0054	58.8	.....	1.1
3	4.9988	5.0099	5.0043	.0007	.....	60.4	.....	0.

RED OAK.

1	5.0125	4.9758	4.9941	.0063	.....	108.3	.....	3.4
2	5.0099	5.0145	5.0122	.0228	.....	106.1	.....	2.7
3	4.9903	5.0120	5.0011	.0006	.....	105.5	0.7	.....

Samples exposed out of doors, 1 foot above ground, 8 hours. Overcast sky; temperature, 35° F.

WHITE PINE.

No. of sample.	Gauged length.					Weight.		
	A.	B.	Mean.	Total gain.	Total loss.	Total.	Total gain.	Total loss.
	Inches.	*Inches.*	*Inches.*	*Inch.*	*Inch.*	*Grams.*	*Gram.*	*Gram.*
1	4.9971	4.9951	4.9961	.....	.0101	58.8	0.8	.....
2	4.9973	4.9945	4.9959	.....	.0046	59.1	.....	0.8
3	4.9989	5.0099	5.0044	.0008	.....	60.7	0.3	.....

RED OAK.

1	5.0187	4.9841	5.0014	.0136	.....	109.3	.....	2.4
2	5.0173	5.0244	5.0208	.0314	.....	107.1	.....	1.7
3	4.9908	5.0127	5.0017	.0012	.....	106.1	1.3	.....

The accompanying diagram shows the changes in length and weight of the crosswise samples Nos. 1 of each kind of wood used, the results being reduced to changes in length per linear foot and changes in weight per cubic foot.

The details show there were slight changes pertaining to the lengthwise samples.

Referring to the reduced results on the diagram, it was found, taking the specimens as they came from the carpenter's shop and having been recently taken from the storehouse, where they have been seasoning upwards of 30 years, that exposure out of doors over night in a foggy atmosphere, but protected by a board roof from the direct action of the elements, caused each kind of wood to absorb an appreciable amount of moisture, and also show a decided change in length.

The pine and oak crosswise specimens expanded ″.066 and ″.045 per linear foot, respectively, and the amount of water absorbed was nearly the same in each, being 1.1 and 1.14 pounds per cubic foot, respectively.

They were then suspended in the current of hot dry air over a steam boiler, where they remained an interval of 3½ hours, the thermometer registering 125° F. At the end of this time the oak had lost more in weight than the pine and also contracted more in length.

Four hours' exposure over thawing snow was accompanied by a gain in weight, and on the part of the pine specimen a gain in length; a very slight change in the length of the oak occurred.

After a further exposure in the open air of two nights and one day the pine had recovered all the weight lost over the steam boiler, and had gained 0.3 pound per cubic foot in weight and ″.27 per foot in length.

The oak in the meantime gained both in weight and in length, but was still below the original observations.

The samples were next placed in a steam-box and weighed at the end of 4 hours, and again after 3 hours' additional exposure, making 7 hours total in the steam-box.

The pine samples retained their shape better than the oak. The latter were badly distorted in shape, as the measurements on opposite faces recorded in the details clearly show.

A remarkable gain in the length of the oak wood occurred, exceeding the total gain in the length of the pine more than seven times, although

the amount of moisture absorbed exceeded the pine only about 1 cent.

Following this treatment the samples were dried over the s boiler, in a current of hot air, as before.

The oak returned to practically its original length, whereas the was considerably shorter than when first measured.

Both samples showed a loss in weight, and greater than b observed.

Other treatment followed, as shown on the diagram.

Under the final observations the pine was shorter than origin but weighed more.

Reverse conditions prevailed with the oak, which was longer when first observed, but weighed less.

In these tests no account has been taken of the direct tempera effects independent of changes due to absorption of moisture.

It would be inferred from the relative behavior of the two kin wood that data to be of practical value would need to be the r of prolonged exposure to the ordinary changes of weather. The lence of the steam-box treatment seems to have been the mean liberating moisture in the oak which years of seasoning had unable to accomplish, and, whether temporary or otherwise, the was in a swelled state at the close of these tests.

On the other hand, the pine wood showed a marked tendenc assume a shrunken state after the immediate effect of the steam was over.

In the presence of steam the oak displayed the greater chang length, and when for the first time exposed to the hot air of the st boiler, but under the earlier changes observed, the swelling was than the pine, and under the last four conditions of the tests the showed less change in length than the pine.

The rate of change during the intervals between the last four ob vations differed in the two woods.

It may be remarked that all the samples examined were charac ized by a promptness to follow atmospheric changes, although data hardly enable predictions to be made of the total changes wh might occur from season to season throughout the year.

In steam boi

temperatur

sky.

ENDURANCE OF ROTATING SHAFTS

FROM

STEEL BARS.

ENDURANCE OF ROTATING SHAFTS.

The speed of rotation of the shafts included in this report was about 1,500 per minute.

They were run under fiber stresses ranging from 30,000 to 40,000 pounds per square inch.

The shafts were supported at the ends 33″ apart and loaded at the middle on a double bearing, each part of which was one-half inch long and spaced 4″ apart, center to center.

The temperature of the shafts was maintained between 70° and 80° F. by means of a stream of water feeding a trough in which the shaft rotated.

The shafts furnished by the Bethlehem Iron Company comprised nickel-steel bars containing a range of nickel from 3.282 to 27.353 per cent and carbon steels in which the carbons ranged from 0.24 to 0.66 per cent.

Two samples of each grade of metal were furnished, one of which was annealed, the other oil hardened and annealed.

With one exception, 27.353 per cent nickel, the oil-hardened specimens showed the higher elastic limits and tensile strength.

The endurance record generally followed the tensile properties, comparing the bars of the same composition, an exception being found in the 5.661 per cent nickel steel.

And, in general, it may be said that, working under a fiber stress of 40,000 pounds per square inch, bars of high elastic limits and tensile strength showed superior endurance to those of low tensile properties, but no proportionality appears to exist between the two classes of tests.

It is remarkable that the fiber stress employed caused rupture so soon in each of the shafts notwithstanding the very high elastic limits shown by the tension tests of some of the bars.

Under the conditions of loading by means of alternate stresses it therefore appears that the shafts of high elastic limits possess only temporary advantages.

The limit of stress under which the metal can be indefinitely alternately loaded has clearly not been elevated to 40,000 pounds per square inch by the chemical composition or treatment of these shafts.

The number of repetitions of stresses necessary to cause rupture is much augmented as the loads are reduced below 40,000 pounds per square inch, as shown by the record of the Gautier steel bars which were loaded with 35,000 and 30,000 pounds per square inch.

The test of specimen No. 298 was discontinued at 50,000,000 rotations. The metal will be examined by tensile stress.

No. 280.

BETHLEHEM IRON COMPANY'S NICKEL STEEL, ANNEALED. MARKS, 7×1 S.

Turned down from rod 1¼″ diameter. 0.26 per cent carbon, 3.282 per cent nickel.

Diameter, 1″. Speed of rotation, 1,500 per minute.

Length between end supports, 33″.

Loaded over 4″ length at middle.

Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2014	.1694	.2013	.0319	.0001	
			b	.2016	.1695	.2014	.0319	.0002	
			c	.2016	.1694	.2014	.0320	.0002	
	10,000	10,000	*a*	.2015	.1690	.2014	.0324	.0001	
			b	.2016	.1691	.2015	.0324	.0001	
			c	.2016	.1691	.2014	.0324	.0002	
	40,000	50,000	*a*	.2015	.1687	.2014	.0327	.0001	
			b	.2016	.1689	.2015	.0326	.0001	
			c	.2016	.1689	.2015	.0326	.0001	
	0	50,000	*a*	.2016	.1692	.2014	.0322	.0002	Rested 15 hours.
			b	.2017	.1695	.2015	.0319	.0002	
			c	.2016	.1690	.2015	.0325	.0001	
	50,000	100,000	*a*	.2015	.1689	.2014	.0325	.0001	
			b	.2016	.1689	.2015	.0326	.0001	
			c	.2017	.1690	.2015	.0325	.0002	
	524,900	624,900	*a*	.2015	.1688	.2014	.0326	.0001	
			b	.2015	.1690	.2015	.0325	0.	
			c	.2016	.1689	.2015	.0326	.0001	
	0	624,900	*a*	.2014	.1688	.2014	.0326	0.	Do.
			b	.2016	.1689	.2015	.0326	.0001	
			c	.2017	.1689	.2015	.0326	.0002	
	645,100	1,270,000	*a*	.2015	.1687	.2014	.0327	.0001	
			b	.2017	.1688	.2015	.0327	.0002	
			c	.2017	.1690	.2015	.0325	.0002	
	0	1,270,000	*a*	.2014	.1689	.2014	.0325	0.	Rested 39 hours.
			b	.2017	.1690	.2015	.0325	.0002	
			c	.2016	.1690	.2014	.0324	.0002	
	577,500	1,847,500							Shaft ruptured at the south edge of south middle bearing.

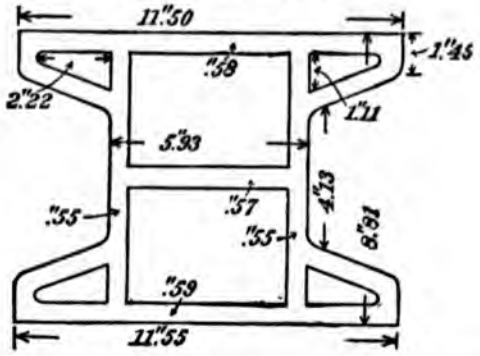
No. 281.

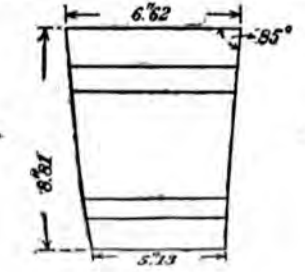
BETHLEHEM IRON COMPANY'S NICKEL STEEL, OIL HARDENED AND ANNEALED. MARKS, 7 × 1 HS.

Turned down from rod 1¼″ diameter. 0.26 per cent carbon, 3.282 per cent nickel.
Diameter, 1″. Speed of rotation, 1,500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2022	.1694	.2021	.0327	.0001	
			b	.2024	.1694	.2022	.0328	.0002	
			c	.2022	.1692	.2020	.0328	.0002	
	10,000	10,000	*a*	.2020	.1694	.2020	.0326	0.	
			b	.2024	.1697	.2022	.0325	.0002	
			c	.2022	.1695	.2020	.0325	.0002	
	40,000	50,000	*a*	.2022	.1695	.2020	.0325	.0002	
			b	.2023	.1695	.2022	.0327	.0001	
			c	.2023	.1693	.2020	.0327	.0003	
	50,000	100,000	*a*	.2021	.1695	.2020	.0325	.0001	
			b	.2025	.1697	.2023	.0326	.0002	
			c	.2022	.1695	.2021	.0326	.0001	
	373,000	473,000	*a*	.2021	.1697	.2020	.0323	.0001	
			b	.2024	.1699	.2023	.0324	.0001	
			c	.2022	.1696	.2020	.0324	.0002	
	0	473,000	*a*	.2024	.1697	.2022	.0325	.0002	Rested 15 hours.
			b	.2025	.1701	.2024	.0323	.0001	
			c	.2022	.1696	.2021	.0325	.0001	
	647,000	1,120,300	*a*	.2023	.1693	.2020	.0327	.0003	
			b	.2024	.1700	.2023	.0323	.0001	
			c	.2021	.1693	.2020	.0327	.0001	
	0	1,120,000	*a*	.2022	.1695	.2018	.0323	.0004	Do.
			b	.2022	.1700	.2021	.0321	.0001	
			c	.2022	.1698	.2021	.0323	.0001	
	640,000	1,760,000	*a*	.2020	.1694	.2019	.0325	.0001	
			b	.2023	.1699	.2021	.0322	.0002	
			c	.2024	.1696	.2022	.0326	.0002	
	0	1,760,000	*a*	.2022	.1692	.2019	.0327	.0003	Do.
			b	.2023	.1699	.2022	.0323	.0001	
			c	.2022	.1694	.2021	.0327	.0001	
	55,200	1,815,200							Shaft ruptured at north edge of south middle bearing.

End view of Nos. 7868-7872.



No. of test.	Side view.	Description.	Color.	Weight.		Net sectional area.	First crack.	Ultimate strength.		Remarks
								Total.	Per square inch.	
				Pounds.	*Ounces.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7868		9" end pressure arch. No. 6 key tile.	Dark buff...	12	9	34.33	102,800	102,800	2,994	

No. 293.

BETHLEHEM IRON COMPANY'S NICKEL STEEL, OIL HARDENED AND ANNEALED. MARKS, 7×2 H S.

Turned down from rod $1\frac{1}{4}''$ diameter. 0.25 per cent carbon, 4.514 per cent nickel.

Diameter, $1''$. Speed of rotation, 1,500 per minute.

Length between end supports, $33''$.

Loaded over $4''$ length at middle.

Deflections measured on chord of $10''$.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2008	.1681	.2006	.0325	.0002	
			b	.2008	.1681	.2006	.0325	.0002	
			c	.2008	.1682	.2005	.0323	.0003	
	10,000	10,000	*a*	.2008	.1680	.2005	.0325	.0003	
			b	.2007	.1680	.2005	.0325	.0002	
			c	.2007	.1681	.2006	.0325	.0001	
	645,700	655,700							Rested 39 hours.
	0	655,700	*a*	.2009	.1680	.2006	.0326	.0003	
			b	.2009	.1680	.2006	.0326	.0003	
			c	.2009	.1681	.2006	.0325	.0003	
	663,000	1,318,700							Rested 16 hours.
	0	1,318,700	*a*	.2006	.1681	.2004	.0323	.0002	
			b	.2007	.1684	.2005	.0321	.0002	
			c	.2008	.1684	.2006	.0322	.0002	
	554,600	1,873,300							Rested 15 hours.
	0	1,873,300	*a*	.2005	.1684	.2004	.0320	.0001	
			b	.2007	.1685	.2005	.0320	.0002	
			c	.2007	.1687	.2005	.0318	.0002	
	681,400	2,554,700							Do.
	0	2,554,700	*a*	.2006	.1681	.2005	.0324	.0001	
			b	.2007	.1684	.2005	.0321	.0002	
			c	.2008	.1683	.2005	.0322	.0003	
	675,500	3,230,200							Do.
	0	3,230,200	*a*	.2005	.1678	.2005	.0327	0.	
			b	.2004	.1679	.2004	.0325	0.	
			c	.2007	.1680	.2004	.0324	.0003	
	66,500	3,296,700							Shaft ruptured at the north edge of south middle bearing.

No. 290.

BETHLEHEM IRON COMPANY'S NICKEL STEEL, ANNEALED. MARKS, 7×3 S.

Turned down from rod 1¼″ diameter. 0.29 per cent carbon, 5.661 per cent nickel.
Diameter, 1″. Speed of rotation, 1,500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2007	.1666	.2005	.0339	.0002	
			b	.2009	.1667	.2007	.0340	.0002	
			c	.2010	.1668	.2007	.0339	.0003	
	10,000	10,000	*a*	.2007	.1669	.2004	.0335	.0003	
			b	.2006	.1668	.2004	.0336	.0002	
			c	.2008	.1668	.2003	.0335	.0005	
	117,800	127,800							Rested 39 hours.
	0	127,800	*a*	.2007	.1669	.2005	.0336	.0002	
			b	.2007	.1668	.2004	.0336	.0003	
			c	.2005	.1669	.2005	.0336	0.	
	677,500	805,300							Rested 15 hours.
	0	805,300	*a*	.2008	.1670	.2006	.0336	.0002	
			b	.2010	.1669	.2006	.0337	.0004	
			c	.2010	.1670	.2006	.0336	.0004	
	670,700	1,476,000							Do.
	0	1,476,000	*a*	.2006	.1670	.2006	.0336	0.	
			b	.2008	.1670	.2008	.0338	0.	
			c	.2010	.1670	.2007	.0337	.0003	
	669,400	2,145,400							Do.
	0	2,145,400	*a*	.2009	.1668	.2007	.0339	.0002	
			b	.2010	.1670	.2007	.0337	.0003	
			c	.2010	.1670	.2009	.0339	.0001	
	672,200	2,817,600							Do.
	0	2,817,600	*a*	.2009	.1670	.2006	.0336	.0003	
			b	.2010	.1670	.2008	.0338	.0002	
			c	.2010	.1669	.2008	.0339	.0002	
	681,900	3,499,500							Do.
	0	3,499,500	*a*	.2009	.1669	.2007	.0338	.0002	
			b	.2009	.1671	.2007	.0336	.0002	
			c	.2010	.1671	.2008	.0337	.0002	
	679,400	4,178,900							Rested 39 hours.
	0	4,178,900	*a*	.2009	.1670	.2007	.0337	.0002	
			b	.2010	.1672	.2008	.0336	.0002	
			c	.2010	.1670	.2008	.0338	.0002	
	189,500	4,368,400							Shaft ruptured at the north edge of south middle bearing.

No. 291.

BETHLEHEM IRON COMPANY'S NICKEL STEEL, OIL HARDENED AND ANNEALED. MARKS, 7×3 H S.

Turned down from rod 1¼″ diameter. 0.29 per cent carbon, 3.661 per cent nickel.

Diameter, 1″. Speed of rotation, 1,500 per minute.

Length between end supports, 33″.

Loaded over 4″ length at middle.

Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	0.2012	0.1681	0.2005	0.0324	0.0007	
			b	.2009	.1684	.2007	.0323	.0002	
			c	.2008	.1683	.2006	.0323	.0002	
	10,000	10,000	*a*	.2008	.1679	.2008	.0329	0.	
			b	.2012	.1681	.2011	.0330	.0001	
			c	.2012	.1680	.2010	.0330	.0002	
	551,300	561,300	.....	.....	.....	.....	.....	.....	Rested 15 hours.
	0	561,300	*a*	.2012	.1679	.2010	.0331	.0002	
			b	.2014	.1686	.2012	.0326	.0002	
			c	.2012	.1682	.2010	.0328	.0002	
	647,400	1,208,700	.....	.....	.....	.....	.....	.....	Do.
	0	1,208,700	*a*	.2010	.1680	.2009	.0329	.0001	
			b	.2012	.1683	.2010	.0327	.0002	
			c	.2010	1683	.2010	.0327	0.	
	659,000	1,867,700	.....	.....	.....	.....	.....	.....	Do.
	0	1,867,700	*a*	.2011	.1683	.2010	.0327	.0001	
			b	.2013	.1684	.2010	.0326	.0003	
			c	.2011	.1682	.2010	.0328	.0001	
	680,000	2,547,700	.....	.....	.....	.....	.....	.....	Do.
	0	2,547,700	*a*	.2009	.1684	.2007	.0323	.0002	
			b	.2012	.1684	.2010	.0326	.0002	
			c	.2012	.1682	.2009	.0327	.0003	
	694,200	3,241,900	.....	.....	.....	.....	.....	.....	Rested 30 hours.
	0	3,241,900	*a*	.2008	.1683	.2008	.0325	0.	
			b	.2014	.1687	.2011	.0327	.0003	
			c	.2012	.1685	.2010	.0325	.0002	
	553,200	3,795,200	.....	.....	.....	.....	.....	.....	Shaft ruptured at the north edge of south middle bearing.

No. 282.

BETHLEHEM IRON COMPANY'S NICKEL STEEL, ANNEALED. MARKS. 7×4 S.

Turned down from rod 1¼″ diameter. 0.539 per cent carbon, 27.353 per cent nickel.
Diameter, 1.″ Speed of rotation, 1,500 per minute.
Length between end supports, 33.″
Loaded over 4″ length at middle.
Deflections measured on chord of 10.″

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2006	.1623	.2006	.0383	0.	
			b	.2012	.1628	.2011	.0383	.0004	
			c	.2006	.1621	.2005	.0384	.0001	
	10,000	10,000	*a*	.2005	.1624	.2005	.0381	0.	
			b	.2013	.1630	.2012	.0382	.0001	
			c	.2005	.1622	.2004	.0382	.0001	
	40,000	50,000	*a*	.2006	.1620	.2005	.0385	.0001	
			b	.2013	.1627	.2013	.0386	0.	
			c	.2005	.1620	.2005	.0385	0.	
	50,000	100,000	*a*	.2006	.1620	.2005	.0385	.0001	
			b	.2013	.1627	.2013	.0386	0.	
			c	.2005	.1620	.2005	.0385	0.	
	290,000	390,000	*a*	.2005	.1618	.2004	.0386	.0001	
			b	.2012	.1627	.2012	.0385	0.	
			c	.2005	.1619	.2005	.0386	0.	
	0	390,000	*a*	.2007	.1621	.2006	.0385	.0001	Rested 15 hours.
			b	.2014	.1630	.2013	.0383	.0001	
			c	.2005	.1620	.2005	.0385	0.	
	638,000	1,028,000	*a*	.2005	.1621	.2004	.0383	0.	
			b	.2012	.1630	.2012	.0382	.0001	
			c	.2005	.1621	.2004	.0383	0.	
	0	1,028,000	*a*	.2005	.1618	.2005	.0387	0.	Rested 39 hours.
			b	.2014	.1628	.2013	.0385	.0001	
			c	.2005	.1618	.2005	.0387	0.	
	552,000	1,580,000	*a*	.2005	.1622	.2004	.0382	.0001	
			b	.2013	.1630	.2012	.0382	.0001	
			c	.2005	.1620	.2004	.0384	.0001	
	0	1,580,000	*a*	.2005	.1624	.2004	.0380	.0001	Rested 15 hours.
			b	.2014	.1632	.2014	.0382	0.	
			c	.2004	.1618	.2004	.0386	0.	
	0	1,580,000	*a*	.2004	.1619	.2004	.0385	0.	Measurements repeated.
			b	.2013	.1628	.2013	.0385	0.	
			c	.2004	.1620	.2004	.0384	0.	
	620,000	2,200,000	*a*	.2006	.1620	.2005	.0385	.0001	
			b	.2014	.1630	.2014	.0384	0.	
			c	.2005	.1620	.2005	.0385	0.	
	0	2,200,000	*a*	.2005	.1621	.2005	.0384	0.	Rested 15 hours.
			b	.2014	.1630	.2014	.0384	0.	
			c	.2005	.1621	.2005	.0384	0.	
	195,600	2,395,600							Shaft ruptured about ″.15 north of south edge of south middle bearing.

No. 283.

BETHLEHEM IRON COMPANY'S NICKEL STEEL, OIL HARDENED AND ANNEALED. MARKS, 7×4 H S.

Turned down from rod 1¼″ diameter. 0.539 per cent carbon, 27.353 per cent nickel.
Diameter, 1″. Speed of rotation, 1,500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.1998	.1615	.1997	.0382	.0001	
			b	.1990	.1607	.1989	.0382	.0001	
			c	.2000	.1618	.1999	.0381	.0001	
	10,000	10,000	*a*	.2000	.1617	.1999	.0382	.0001	
			b	.1987	.1604	.1985	.0381	.0002	
			c	.2002	.1618	.2000	.0382	.0002	
	40,000	50,000	*a*	.1998	.1616	.1998	.0382	0.	
			b	.1985	.1602	.1984	.0382	.0001	
			c	.2001	.1617	.2000	.0383	.0001	
	50,000	100,000	*a*	.2000	.1616	.2000	.0384	0.	
			b	.1986	.1602	.1985	.0383	.0001	
			c	.2002	.1618	.2000	.0382	.0002	
	60,000	160,000	*a*	.1998	.1617	.1998	.0381	0.	
			b	.1986	.1602	.1984	.0382	.0002	
			c	.2001	.1615	.2000	.0385	.0001	
									Rested 15 hours.
	0	160,000	*a*	.2000	.1618	.1997	.0379	.0003	
			b	.1986	.1605	.1985	.0380	.0001	
			c	.2002	.1617	.2000	.0383	.0002	
	638,300	798,300	.....	.....	.....	.....	.....	.....	Do.
	0	798,300	*a*	.2001	.1615	.2000	.0385	.0001	
			b	.1985	.1600	.1985	.0385	0.	
			c	.2001	.1615	.2000	.0385	.0001	
	289,900	1,088,200	.....	.....	.....	.....	.....	.....	Shaft ruptured about .15 from the south edge of south middle bearing.

No. 288.

BETHLEHEM IRON COMPANY'S STEEL, ANNEALED. MARKS, 7×5 S.

Turned down from rod 1¼″ diameter. 0.24 per cent carbon.
Diameter, 1″. Speed of rotation, 1,500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.1998	.1679	.1997	.0318	.0001	
			b	.2000	.1680	.1998	.0318	.0002	
			c	.2000	.1681	.1998	.0317	.0002	
	10,000	10,000	*a*	.2078	.1613	.1943	.0330	.0135	
			b	.2036	.1612	.1940	.0328	.0096	
			c	.2046	.1614	.1943	.0329	.0103	
	219,300	229,300	.....	.....	.....	.....	.....	.....	Shaft ruptured at the north edge of south middle bearing.

No. 289.

BETHLEHEM IRON COMPANY'S STEEL, OIL HARDENED AND ANNEALED. MARKS, 7 × 5 H S.

Turned down from rod 1¼″ diameter. 0.24 per cent carbon.
Diameter 1″. Speed of rotation, 1,500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2012	.1688	.2010	.0322	.0002	
			b	.2010	.1688	.2000	.0321	.0001	
			c	.2013	.1689	.2010	.0321	.0003	
	10,000	10,000	*a*	.1998	.1661	.1990	.0329	.0008	
			b	.2010	.1664	.1991	.0327	.0019	
			c	.2038	.1669	.1998	.0329	.0040	
	338,000	348,000	.....	.....	.....	.....	.....	.....	Shaft ruptured about the center of north middle bearing.

No. 286.

BETHLEHEM IRON COMPANY'S STEEL, ANNEALED. MARKS, 7×6 S.

Turned down from rod 1¼″ diameter. 0.42 per cent carbon.
Diameter, 1″. Speed of rotation, 1,500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2009	.1680	.2000	.0320	.0009	
			b	.2000	.1680	.1998	.0318	.0002	
			c	.2002	.1682	.2000	.0318	.0002	
	10,000	10,000	*a*	.1975	.1618	.1944	.0326	.0031	
			b	.2062	.1630	.1956	.0326	.0106	
			c	.1956	.1619	.1951	.0332	.0005	
	215,900	225,900	.....	.....	.....	.....	.....	.....	Shaft ruptured at the south edge of south middle bearing.

No. 287.

BETHLEHEM IRON COMPANY'S STEEL, OIL HARDENED AND ANNEALED. MARKS, 7×6 H S.

Turned down from rod 1¼″ diameter. 0.42 per cent carbon.
Diameter, 1″. Speed of rotation, 1,500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2003	.1686	.2001	.0315	.0002	
			b	.2003	.1685	.2002	.0317	.0001	
			c	.2005	.1685	.2004	.0319	.0001	
	10,000	10,000	*a*	.1998	.1677	.1995	.0318	.0003	
			b	.2007	.1678	.1998	.0320	.0009	
			c	.2004	.1679	.1999	.0320	.0005	
	628,300	638,300	.....	.....	.....	.....	.....	.....	Rested 15 hours.
	0	638,300	*a*	.2001	.1675	.1995	.0320	.0006	
			b	.2001	.1671	.1994	.0323	.0007	
			c	.2011	.1669	.1997	.0328	.0014	
	17,300	655,600	.....	.....	.....	.....	.....	.....	Shaft ruptured about ".15 south of north middle bearing.

No. 284.

BETHLEHEM IRON COMPANY'S STEEL, ANNEALED. MARKS, 7×7 S.

Turned down from rod 1¼″ diameter. 0.46 per cent carbon.
Diameter 1″. Speed of rotation, 1,500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2019	.1700	.2018	.0318	.0001	
			b	.2020	.1702	.2019	.0317	.0001	
			c	.2020	.1701	.2019	.0318	.0001	
	10,000	10,000	*a*	.2029	.1672	.1999	.0327	.0030	
			b	.2033	.1677	.2004	.0327	.0029	
			c	.2034	.1680	.2004	.0324	.0030	
	40,000	50,000	*a*	.1988	.1655	.1985	.0330	.0003	
			b	.2032	.1697	.1997	.0330	.0035	
			c	.2045	.1668	.2000	.0332	.0045	
	50,000	100,000	*a*	.2043	.1663	.1995	.0332	.0048	
			b	.2023	.1664	.1996	.0332	.0027	
			c	.2040	.1669	.1999	.0330	.0041	
	51,000	151,000	*a*	.2034	.1664	.1995	.0331	.0039	
			b	.2035	.1663	.1995	.0332	.0040	
			c	.2047	.1669	.2000	.0331	.0047	
									Rested 15 hours.
	0	151,000	*a*	.2033	.1668	.1995	.0327	.0038	
			b	.2039	.1675	.2000	.0325	.0039	
			c	.2039	.1675	.2001	.0326	.0038	
	7,900	158,900	.....	.....	.....	.....	.....	.....	Rested 45 hours.
	0	158,900	*a*	.2034	.1671	.1997	.0326	.0037	
			b	.2023	.1670	.1998	.0328	.0025	
			c	.2043	.1674	.2001	.0327	.0042	
									Rested 48 hours.
	312,500	471,400	.....	.....	.....	.....	.....	.....	Rested 15 hours.
	0	471,400	*a*	.2014	.1666	.1990	.0324	.0024	
			b	.2045	.1677	.2000	.0323	.0045	
			c	.2023	.1673	.1996	.0323	.0027	
	506,200	976,600	.....	.....	.....	.....	.....	.....	Shaft ruptured about ".15 north of south edge of south middle bearing.

No. 285.

BETHLEHEM IRON COMPANY'S STEEL, OIL HARDENED AND ANNEALED. MARKS, 7×7 H S.

Turned down from rod 1¼″ diameter. 0.46 per cent carbon.
Diameter, 1″. Speed of rotation, 1,500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2004	.1683	.2001	.0318	.0003	
			b	.2004	.1681	.2002	.0321	.0002	
			c	.2005	.1683	.2004	.0321	.0001	
	10,000	10,000	*a*	.2002	.1682	.2002	.0320	0.	
			b	.2004	.1680	.2002	.0322	.0002	
			c	.2005	.1681	.2004	.0323	.0001	
	40,000	50,000	*a*	.2003	.1682	.2002	.0320	.0001	
			b	.2003	.1679	.2000	.0321	.0003	
			c	.2003	.1682	.2003	.0321	0.	
	534,400	584,400	.....	.....	.....	.....	.....	.....	Rested 15 hours.
	0	584,400	*a*	.2006	.1678	.2001	.0323	.0005	
			b	.2005	.1674	.1998	.0324	.0007	
			c	.2006	.1677	.2002	.0325	.0004	
	643,300	1,227,700	.....	.....	.....	.....	.....	.....	Rested 39 hours.
	0	1,227,700	*a*	.2005	.1676	.2002	.0326	.0003	
			b	.2006	.1677	.2001	.0324	.0005	
			c	.2007	.1679	.2003	.0324	.0004	
	429,800	1,657,500	.....	.....	.....	.....	.....	.....	Shaft ruptured at north edge of north middle bearing.

No. 294.

BETHLEHEM IRON COMPANY'S STEEL, ANNEALED. MARKS, 7×8 S.

Turned down from rod 1¼″ diameter. 0.66 per cent carbon.
Diameter, 1″. Speed of rotation, 1,500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2007	.1692	.2006	.0314	.0001	
			b	.2006	.1690	.2005	.0315	.0001	
			c	.2010	.1693	.2008	.0315	.0002	
	10,000	10,000	*a*	.2004	.1687	.2003	.0316	.0001	
			b	.2004	.1689	.2004	.0315	0.	
			c	.2007	.1690	.2006	.0316	.0001	
	320,100	330,100							Rested 15 hours.
	0	330,100	*a*	.2004	.1690	.2003	.0313	.0001	
			b	.2003	.1688	.2002	.0314	.0001	
			c	.2007	.1691	.2007	.0316	0.	
	655,000	985,100							Rested 39 hours.
	0	985,100	*a*	.2005	.1690	.2004	.0314	.0001	
			b	.2004	.1687	.2003	.0316	.0001	
			c	.2008	.1690	.2008	.0316	0.	
	664,500	1,649,600							Rested 15 hours.
	0	1,649,600	*a*	.2006	.1692	.2006	.0314	0.	
			b	.2006	.1689	.2006	.0317	0.	
			c	.2008	.1689	.2007	.0318	.0001	
	652,000	2,301,600							Do.
	0	2,301,600	*a*	.2006	.1690	.2005	.0315	.0001	
			b	.2006	.1689	.2005	.0316	.0001	
			c	.2009	.1694	.2008	.0314	.0001	
	678,800	2,979,400							Do.
	0	2,979,400	*a*	.2005	.1691	.2004	.0313	.0001	
			b	.2006	.1690	.2005	.0315	.0001	
			c	.2009	.1694	.2008	.0314	.0001	
	670,500	3,649,900							Do.
	0	3,649,900	*a*	.2005	.1685	.2004	.0319	.0001	
			b	.2007	.1690	.2006	.0316	.0001	
			c	.2008	.1689	.2007	.0318	.0001	
	39,100	3,689,000							Shaft ruptured midway north and south middle bearings.

No. 295.

BETHLEHEM IRON COMPANY'S STEEL, OIL HARDENED AND ANNEALED. MARKS, 7×8 H S.

Turned down from rod 1¼″ diameter. 0.66 per cent carbon.
Diameter, 1″. Speed of rotation, 1,500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2010	.1695	.2009	.0314	.0001	
			b	.2004	.1689	.2004	.0315	0.	
			c	.2006	.1694	.2006	.0312	0.	
	10,000	10,000	*a*	.2009	.1696	.2009	.0313	0.	
			b	.2004	.1688	.2003	.0315	.0001	
			c	.2006	.1691	.2006	.0315	0.	
	69,100	79,100	.....	.....	.....	.....	.....	.....	Rested 39 hours.
	0	79,100	*a*	.2010	.1699	.2010	.0311	0.	
			b	.2004	.1692	.2004	.0312	0.	
			c	.2007	.1692	.2006	.0314	.0001	
	650,900	730,000	.....	.....	.....	.....	.....	.....	Rested 15 hours.
	0	730,000	*a*	.2010	.1698	.2010	.0312	0.	
			b	.2004	.1692	.2004	.0312	0.	
			c	.2007	.1692	.2006	.0314	.0001	
	677,800	1,407,800	.....	.....	.....	.....	.....	.....	Do.
	700,400	2,108,200	.....	.....	.....	.....	.....	.....	Rested 39 hours.
	0	2,108,200	*a*	.2010	.1695	.2010	.0315	0.	
			b	.2004	.1690	.2004	.0314	0.	
			c	.2007	.1692	.2006	.0314	.0001	
	663,000	2,771,200	.....	.....	.....	.....	.....	.....	Rested 15 hours.
	0	2,771,200	*a*	.2008	.1694	.2008	.0314	0.	
			b	.2001	.1688	.2000	.0312	.0001	
			c	.2004	.1692	.2004	.0312	0.	
	653,000	3,424,200	.....	.....	.....	.....	.....	.....	Rested 39 hours.
	0	3,424,200	*a*	.2008	.1694	.2007	.0313	.0001	
			b	.2000	.1689	.2000	.0311	0.	
			c	.2004	.1691	.2004	.0313	0.	
	652,500	4,076,700	.....	.....	.....	.....	.....	.....	Rested 15 hours.
	0	4,076,700	*a*	.2007	.1694	.2007	.0313	0.	
			b	.2000	.1687	.1999	.0312	.0001	
			c	.2004	.1693	.2004	.0311	0.	
	246,900	4,323,600	.....	.....	.....	.....	.....	.....	Shaft ruptured about ″.25 south of north middle bearing.

No. 296.

GAUTIER STEEL. MARKS, 7 C_2.

Turned down from rod 1¼″ diameter. 0.733 per cent carbon.
Diameter, 1″. Speed of rotation, 1,500 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
30,000	0	0	*a*	.2030	.1787	.2029	.0242	.0001	
			b	.2033	.1790	.2032	.0242	.0001	
			c	.2028	.1786	.2028	.0242	0.	
	10,000	10,000	*a*	.2029	.1788	.2029	.0241	0.	
			b	.2033	.1790	.2032	.0242	.0001	
			c	.2028	.1786	.2027	.0241	.0001	
	601,500	611,500							Rested 39 hours.
	431,200	1,042,700							Rested 15 hours.
	0	1,042,700	*a*	.2030	.1789	.2029	.0240	.0001	
			b	.2032	.1790	.2032	.0242	0.	
			c	.2028	.1786	.2028	.0242	0.	
	11,504,900	12,547,600							Shaft ruptured about 1″.52 south of north middle bearing.

Rested intervals of 15 to 39 hours after each day's run of about 600,000 rotations.

No. 297.

GAUTIER STEEL. MARKS, 9 B$_4$.

Turned down from rod 1¼″ diameter. 0.824 per cent carbon.
Diameter, 1″. Speed of rotation, 1,500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
39,000	0	0	*a*	.2000	.1761	.1999	.0238	.0001	
			b	.2003	.1763	.2003	.0240	0.	
			c	.2001	.1762	.2001	.0239	0.	
	10,000	10,000	*a*	.2000	.1760	.2000	.0240	0.	
			b	.2004	.1763	.2003	.0240	.0001	
			c	.2001	.1761	.2001	.0240	0.	
	1,240,600	1,250,600							Rested 15 hours.
	0	1,250,600	*a*	.2000	.1761	.2000	.0239	0.	
			b	.2003	.1763	.2001	.0239	.0001	
			c	.2002	.1762	.2002	.0240	0.	
	15,085,600	16,336,200							Shaft ruptured ″.05 from south middle bearing.

Rested intervals of 15 to 39 hours after each day's run of about 600,000 rotations.

No. 278.

GAUTIER STEEL. MARKS, 9 B_6.

Turned down from rod 1¼″ diameter. 0.824 per cent carbon.
Diameter, 1″. Speed of rotation, 1,500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds 35,000	0	0	*a*	*Inch.* .2006	*Inch.* .1720	*Inch.* .2006	*Inch.* .0286	*Inch.* 0.	
			b	.2005	.1719	.2005	.0286	0.	
			c	.2005	.1718	.2004	.0286	.0001	
	473,000	473,000							Rested 39 hours.
	605,000	1,168,000							Rested 20 days.
	12,217,900	13,385,900							Rested 5 days.
	485,100	13,871,000							Shaft ruptured .6 south of north middle bearing.

Rested intervals of 15 to 39 hours after each day's run of about 600,000 rotations.

No. 279.

GAUTIER STEEL. MARKS, 11 B_5.

Turned down from rod 1¼″ diameter. 1.094 per cent carbon.
Diameter 1″. Speed of rotation, 1,500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fibre stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds 35,000	0	0	*a*	*Inch* .2012	*Inch.* .1732	*Inch.* .2011	*Inch.* .0279	*Inch.* .0001	
			b	.2010	.1731	.2010	.0279	0.	
			c	.2010	.1730	.2009	.0279	.0001	
	19,152,300	19,152,300							Shaft ruptured .5 north of south edge of south middle bearing.

Rested intervals of 15 to 39 hours after each day's run of about 600,000 rotations.

No. 298.

GAUTIER STEEL. MARKS, 11 B_4.

Turned down from rod $1\frac{1}{4}''$ diameter. 1,094 per cent carbon.
Diameter, $1''$. Speed of rotation, 1,500 per minute.
Length between end supports, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
30,000		0	*a*	.2011	.1770	.2010	.0240	.0001	
			b	.2013	.1773	.2013	.0240	0.	
			c	.2014	.1773	.2014	.0241	0.	
	10,000	10,000	*a*	.2010	.1770	.2010	.0240	0.	
			b	.2013	.1772	.2013	.0241	0.	
			c	.2014	.1772	.2014	.0242	0.	
	98,900	108,900	.....	.....	.....	.....	.....	.....	Rested 30 hours.
	675,800	784,700	.....	.....	.....	.....	.....	.....	Rested 15 hours.
	674,500	1,459,200	.....	.....	.....	.....	.....	.....	Do.
	0	1,459,200	*a*	.2011	.1768	.2011	.0243	0.	
			b	.2013	.1773	.2013	.0240	0.	
			c	.2014	.1772	.2014	.0242	0.	
	23,315,800	24,775,000	.....	.....	.....	.....	.....	.....	Rested 6 days.
	15,499,500	40,274,500	.....	.....	.....	.....	.....	.....	Rested 33 days.
	9,725,500	50,000,000	.....	.....	.....	.....	.....	.....	Test discontinued; shaft not ruptured.

ENDURANCE OF ROTATING SHAFTS.

SUMMARIZED TABULATION.

No. of test.	Material.	Marks.	Carbon.	Nickel.	Treatment.	Speed of rotation per minute.	Maximum fiber stress per square inch.	Total number of rotations.	Remarks.
			Per cent.	*Per cent.*			*Pounds.*		
280	Bethlehem Iron Company's steel.	7×1 S	0.26	3.282	Annealed	1,500	40,000	1,847,500	Ruptured at south middle bearing.
281	do	7×1 H S	0.26	3.282	Oil hardened and annealed	1,500	40,000	1,815,200	Do.
292	do	7×2 S	0.25	4.514	Annealed	1,500	40,000	2,366,000	Ruptured between middle bearings.
293	do	7×2 H S	0.25	4.514	Oil hardened and annealed	1,500	40,000	3,296,700	Ruptured inside south middle bearing.
290	do	7×3 S	0.29	5.661	Annealed	1,500	40,000	4,368,400	Ruptured at edge of south middle bearing.
291	do	7×3 H S	0.29	5.661	Oil hardened and annealed	1,500	40,000	3,795,200	Do.
282	do	7×4 S	0.539	27.353	Annealed	1,500	40,000	2,495,600	Ruptured between middle bearings.
283	do	7×4 H S	0.539	27.353	Oil hardened and annealed	1,500	40,000	1,088,200	Ruptured 0.15 outside the south middle bearing.
288	do	7×5 S	0.24	.....	Annealed	1,500	40,000	229,300	Ruptured at edge of south middle bearing.
289	do	7×5 H S	0.24	.....	Oil hardened and annealed	1,500	40,000	348,000	Ruptured under north middle bearing.
286	do	7×6 S	0.42	.....	Annealed	1,500	40,000	225,900	Ruptured at edge of south middle bearing.
287	do	7×6 H S	0.42	.....	Oil hardened and annealed	1,500	40,000	655,600	Ruptured between middle bearings.
284	do	7×7 S	0.46	.....	Annealed	1,500	40,000	976,600	Ruptured under south middle bearing.
285	do	7×7 H S	0.46	.....	Oil hardened and annealed	1,500	40,000	1,657,500	Ruptured at edge of north middle bearing.
294	do	7×8 S	0.66	.....	Annealed	1,500	40,000	3,689,000	Ruptured midway middle bearings.
295	do	7×8 H S	0.66	.....	Oil hardened and annealed	1,500	40,000	4,323,600	Ruptured inside north middle bearing.
298	Gautier	11 B_4	1.094	.....	.....	1,500	30,000	50,000,000	Test discontinued. Shaft not ruptured.
296	do	7 C_2	0.733	.....	.....	1,500	30,000	12,547,600	Ruptured inside north middle bearing.
297	do	9 B_4	0.824	.....	.....	1,500	30,000	16,336,200	Ruptured near south middle bearing.
278	do	9 B_3	0.824	.....	.....	1,500	35,000	13,871,000	Ruptured near north middle bearing.
279	do	11 B_3	1.094	.....	.....	1,500	35,000	19,152,300	Ruptured near south middle bearing.

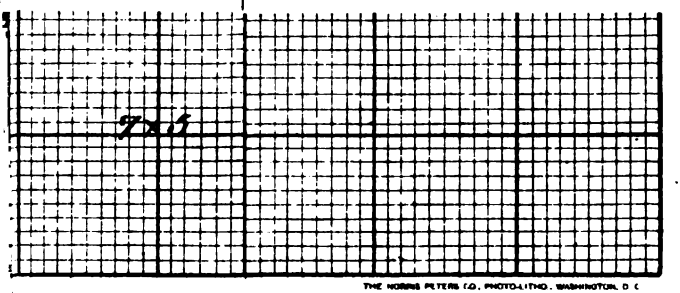
TENSILE TESTS AND CHEMICAL ANALYSES MADE BY THE BETHLEHEM IRON COMPANY OF SPECIMENS FROM STEEL BARS 1¼" DIAMETER BY 40" LONG, FROM WHICH ENDURANCE SHAFTS WERE TAKEN.

Heat No.	Chemical composition.							Treatment.	Marks.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 2 inches.	Contraction of area.	Appearance of fracture.
	C.	Mn.	Si.	P.	S.	Cu.	Ni.			*Inch.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Per ct.*	*Per ct.*	
3,724	.26	.52	.124	.029	.033	.038	3.282	Annealed	7 × 1 S	.497	.194	51,500	81,370	28.75	61.09	Dense gray, cupped.
								do	7 × 1 S	.497	.194	51,500	82,400	30.8	61.33	Dense gray, lipped.
								Oil hardened and annealed	7 × 1 H S	.497	.194	66,950	90,640	26.9	65.04	Do.
									7 × 1 H S	.500	.196	65,180	91,670	26.75	64.49	Do.
21,109	.25	.66	.079	.025	.024	.056	4.514	Annealed	7 × 2 S	.498	.195	61,610	95,490	24.8	57.13	Do.
								do	7 × 2 S	.496	.193	62,100	95,737	24.75	57.49	Do.
								Oil hardened and annealed	7 × 2 H S	.500	.196	101,860	120,190	20.8	60.05	Do.
									7 × 2 H S	.497	.194	97,850	118,450	21.3	60.07	Dense gray, cupped.
21,117	.29	.78	.137	.022	.03	.069	5.661	Annealed	7 × 3 S	.498	.195	86,090	108,840	22.5	58.71	Do.
								do	7 × 3 S	.498	.195	81,110	108,840	23.3	60.23	Dense gray, lipped.
								Oil hardened and annealed	7 × 3 H S	.499	.196	117,610	131,410	19.65	59.88	Do.
									7 × 3 H S	.500	.196	117,140	127,320	21.0	61.05	Do.
11,404	.539	.939	.313	.032	.081	.207	27.353	Annealed	7 × 4 S	.499	.196	48,060	104,820	47.5	63.10	Do.
								do	7 × 4 S	.496	.193	52,785	107,122	35.75	61.33	Do.
								Oil hardened and annealed	7 × 4 H S	.500	.196	46,850	97,780	43.35	60.80	Do.
									7 × 4 H S	.498	.195	47,230	100,620	47.20	60.99	Do.
21,169	.24	.67	.10	.028	.023	.....	.....	Annealed	7 × 5 S	.495	.192	40,560	71,240	32.3	59.81	Do.
								do	7 × 5 S	.497	.194	41,200	72,100	31.1	60.32	Do.
								Oil hardened and annealed	7 × 5 H S	.498	.195	45,170	74,440	33.15	69.93	Do.
									7 × 5 H S	.498	.195	44,150	73,930	31.0	70.19	Do.
3,734	.42	.56	.181	.024	.....	.....	.....	Annealed	7 × 6 S	.497	.194	44,290	80,855	23.0	56.7	Do.
								do	7 × 6 S	.499	.196	47,040	86,410	26.6	51.63	Do.
								Oil hardened and annealed	7 × 6 H S	.500	.196	55,000	92,180	26.05	57.22	Do.
									7 × 6 H S	.499	.196	53,170	89,990	26.8	59.88	Do.
4,436	.46	.68	.116	.022	.....	.....	.....	Annealed	7 × 7 S	.499	.196	48,060	94,600	21.15	47.65	Do.
								do	7 × 7 S	.499	.196	48,060	98,180	21.6	39.83	Do.
								Oil hardened and annealed	7 × 7 H S	.500	.196	61,110	102,830	23.05	51.27	Do.
									7 × 7 H S	.500	.196	62,130	104,400	22.5	50.42	Do.
21,210	.66	.44	.228	.038	.....	.....	.....	Annealed	7 × 8 S	.496	.193	65,205	124,200	7.15	17.28	Do.
								do	7 × 8 S	.497	.194	65,920	127,720	11.95	20.54	Do.
								Oil hardened and annealed	7 × 8 H S	.499	.196	92,040	154,920	13.5	31.48	Do.
									7 × 8 H S	.499	.196	92,040	153,380	13.05	30.15	Do.

TENSILE TESTS AND CHEMICAL ANALYSES OF 1¼″ GAUTIER STEEL BARS FROM WHICH ENDURANCE SHAFTS WERE TAKEN.

No. of test.	Chemical composition.						Marks.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 6 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
	C.	Mn.	Si.	P.	S.	Cu.									
								Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*		" " " " " "
5067	.733	.635	.035	.073	.048	.027	7 A_1	.564	.25	57,000	124,320	11.8	21.4	Granular, radiating from a silky spot at the circumference.	.10, .15, .17, *.10, .10, .09
5068	.824	.361	.097	.043	.030	.028	9 A_4	.564	.25	83,000	134,960	4.0	(*a*)	Fine silky	.04, .05, .04, .04, .04, .03
5069	1.094	.387	.112	.032	.042	.030	11 A_3	.564	.25	70,000	132,320	9.7	15.0	Fine granular, radiating from a point in the circumference.	.10, .12, .10, .09, .09, .08

a Fractured at neck.



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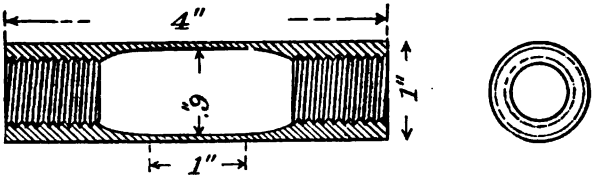
TENSION TESTS OF ANNULAR SPECIMENS FROM RUPTURED ENDURANCE SHAFTS.

Form of specimens.



Material from Gautier steel, $1\frac{1}{4}$" bars.

The marks give the distinguishing number which signifies the grade of the metal, also the letter of the bar and the number of the specimen taken from that bar.

ANNULAR SPECIMENS FROM RUPTURED ENDURANCE SHAFTS.

These specimens were tested for the purpose of ascertaining what changes in tensile properties were caused by the endurance tests.

The results recorded in earlier reports have shown examples in which there was considerable elevation in tensile strength resulting apparently from the repeated alternate stresses which were received by the shafts.

The present series furnish examples of the same kind of effect shown by comparing the strength of the middle with the end specimens.

There are also many instances in which the tensile strength of the middle specimens were much lower than the end ones.

These opposite results are thought to be explained as follows: That the general immediate effect of repeated stresses of sufficient magnitude to ultimately cause rupture is to effect an elevation in tensile strength, which action continues until incipient cracks are developed in the metal.

Annular specimens taken out and tested in the earlier stages may be expected to display increased tenacity, while those which are tested after minute cracks have formed show diminished tenacity.

The metal appears to pass through a state of increased tenacity although the maximum fiber stress due to the transverse load may be below the primitive tensile elastic limit of the metal.

The effect of repeated alternate stresses is further shown in the diminished elongation of the metal under tensile stresses above the elastic limit, and the tendency to obscure the elastic limit and eliminate the jog in the tensile curve caused by rapid elongation without material increase of load.

These changes in properties are usually more pronounced in the mild than in the hard steels.

RECORD OF ENDURANCE SHAFTS AND ANNULAR TENSION SPECIMENS TAKEN FROM SHAFTS AFTER RUPTURE.

Endurance record.							Tensile record of annular specimens from—					
							Outer end of shaft.		Middle of shaft.		Gain or loss of middle specimen.	
No. of test.	Metal.	Marks.	Carbon.	Temperature of test.	Fiber stress per square inch.	Number of rotations.	No. of test.	Tensile strength per square inch.	No. of test.	Tensile strength per square inch.	Gain.	Loss.
			Per cent.	*Deg. F.*	*Pounds.*			*Pounds.*		*Pounds.*	*Pounds.*	*Pounds.*
244	Gautier steel	$1\ B_2$	.161	.....	40,000	169,650	5430	60,620	5431	59,190	.....	1,430
*272	.....do	$1\ B_6$	.161	.....	40,000	567,600	5448	66,910	5449	66,340	.....	570
226	.....do	$1\ A_3$	.161	.....	45,000	82,950	5428	60,130	5429	68,320	8,190	.....
*251	.....do	$1\ B_3$	.161	.....	45,000	149,600	5450	60,600	5451	60,670	70	.....
*225	.....do	$1\ A_4$	.161	.....	50,000	29,950	5452	59,530	5453	58,990	.....	540
218	.....do	$1\ A_5$	.161	.....	52,460	14,800	5426	61,680	5427	37,520	.....	24,160
245	.....do	$2\ B_1$	.172	.....	40,000	111,850	5432	70,070	5433	74,290	4,220	.....
252	.....do	$2\ B_3$	.172	.....	45,000	77,900	5434	72,620	5435	75,100	2,480	.....
259	.....do	$2\ B_5$	.172	.....	50,000	39,600	5436	70,340	5437	72,000	1,660	.....
275	.....do	$3\ B_4$	.341	.....	35,000	14,093,000	5440	87,050	5441	90,670	3,620	.....
241	.....do	$3\ B_1$	.341	.....	40,000	317,100	5118	90,330	5119	92,000	1,670	.....
*246	.....do	$3\ B_2$	.341	.....	40,000	236,150	5454	92,750	5455	92,080	.....	670
228	.....do	$3\ A_5$	.341	.....	45,000	354,750	5116	88,990	5117	35,640	.....	53,350
*232	.....do	$3\ A_6$	.341	.....	45,000	81,900	5456	93,760	5457	90,870	.....	2,890
253	.....do	$3\ B_3$	.341	.....	45,000	149,600	5438	91,010	5439	95,770	4,760	.....
223	.....do	$3\ A_3$	.341	.....	50,000	90,150	5114	87,050	5115	74,760	.....	12,290
216	.....do	$3\ A_4$	.341	.....	52,460	67,950	5112	87,110	5113	58,520	.....	28,590
211	.....do	$3\ A_1$	.341	.....	60,000	11,600	5110	85,370	5111	88,320	2,950	.....
276	.....do	$5\ B_5$	.552	.....	35,000	3,624,400	5442	105,500	5443	104,000	.....	1,500
240	.....do	$5\ B_2$	.552	.....	40,000	153,500	5131	105,910	5132	107,580	1,670	.....
*247	.....do	$5\ B_1$	.552	.....	40,000	160,500	5458	112,210	5459	109,660	.....	2,550
229	.....do	$5\ A_5$	.552	.....	45,000	97,250	5126	103,760	5127	106,000	2,240	.....
*233	.....do	$5\ A_6$	.552	.....	45,000	86,350	5460	119,330	5461	116,580	.....	2,750
254	.....do	$5\ B_3$	.552	.....	45,000	81,250	5444	108,000	5445	108,590	590	.....
222	.....do	$5\ A_4$	.552	.....	50,000	97,800	5124	102,350	5125	87,110	.....	15,240
261	.....do	$5\ B_4$	.552	.....	50,000	67,700	5446	105,300	5447	109,800	4,500	.....
215	.....do	$5\ A_3$	.552	.....	52,460	43,650	5122	102,480	5123	108,000	5,520	.....
268	.....do	$5\ B_6$	.552	35	55,000	377,000	7876	108,450	7877	113,220	4,770	.....
207	.....do	$5\ A_1$	.552	.....	60,000	11,950	5120	100,000	5121	111,480	11,480	.....
208	.....do	$5\ A_2$	.552	.....	60,000	111,800	5102	107,330	5103	77,000	.....	30,330
239	.....do	$7\ A_3$	.733	.....	40,000	148,000	5144	152,610	5145	148,000	.....	4,610
248	.....do	$7\ B_3$	.733	.....	40,000	453,900	5146	158,190	5147	134,900	.....	23,290
234	.....do	$7\ A_6$	.733	.35	45,000	176,650	7878	149,660	7879	144,490	.....	5,170
257	.....do	$7\ B_5$	.733	.....	45,000	244,000	5142	144,360	5143	135,500	.....	8,860
221	.....do	$7\ A_1$	.733	85	50,000	287,700	7880	145,570	7881	133,620	.....	11,950
262	.....do	$7\ B_4$	.733	.....	50,000	120,400	5137	148,930	5138	144,830	.....	4,100

214	....do	7 A_3	.733	100	52,460	92,350	7882	154,760	7883	154,490	.....	270
269	....do	7 B_1	.733	.....	55,000	117,000	5135	149,930	5130	151,740	1,810	.....
198	....do	7 A_1	.733	.....	60,000	218,500	5104	148,660	5105	150,000	1,340	.....
199	....do	7 A_2	.733	.....	60,000	34,000	5133	144,830	5134	154,700	9,870	.....
238	....do	9 A_5	.824	.....	40,000	269,500	5412	139,530	5413	135,440	.....	4,090
240	....do	9 B_1	.824	.....	40,000	481,300	5414	149,190	5415	142,280	.....	6,910
235	....do	9 A_6	.824	.....	45,000	174,400	5410	141,070	5411	137,250	.....	3,820
255	....do	9 B_2	.824	.....	45,000	190,000	7884	155,570	7885	144,360	.....	11,210
220	....do	9 A_4	.824	.....	50,000	103,100	7886	133,420	7887	138,790	5,370	.....
263	....do	9 B_5	.824	.....	50,000	314,600	5408	154,700	5409	158,320	3,620	.....
218	....do	9 A_3	.824	.....	52,460	116,500	7888	146,240	7889	145,910	.....	330
270	....do	9 B_3	.824	.....	55,000	100,300	5148	152,620	5149	158,250	5,630	.....
200	....do	9 A_1	.824	.....	60,000	148,200	5106	138,660	5107	114,760	.....	23,900
237	....do	11 A_5	1.094	.....	40,000	162,400	5422	140,000	5423	142,680	2,680	.....
250	....do	11 B_1	1.094	.....	40,000	466,350	5424	146,780	5425	151,540	4,760	.....
236	....do	11 A_6	1.094	.....	45,000	81,150	7890	138,660	7891	143,220	4,560	.....
256	....do	11 B_2	1.094	.....	45,000	101,500	5420	145,500	5421	147,520	2,020	.....
219	....do	11 A_4	1.094	.....	50,000	159,550	7892	139,060	7893	79,190	.....	59,870
264	....do	11 B_5	1.094	.....	50,000	130,100	5418	145,100	5419	144,700	.....	400
212	....do	11 A_3	1.094	.....	52,460	29,500	7894	145,230	7895	141,210	.....	4,020
271	....do	11 B_3	1.094	.....	55,000	48,300	5416	146,440	5417	144,500	.....	1,940
202	....do	11 A_1	1.094	.....	60,000	99,200	5108	135,330	5109	154,230	18,900	.....

* Specimens annealed before testing.

No. 5428.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 226.

Marks, 1 A_3.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0004	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0015	0.	
6,258	42,000	.0016	.....	Elastic limit.
6,407	43,000	.0019	.....	Load fell.
5,811	39,000	.0091	.....	
5,960	40,000	.0137	.....	
6,109	41,000	.0242	.....	
6,258	42,000	.0261	.....	
6,407	43,000	.0280	.....	
6,556	44,000	.0298	.....	
6,854	46,000	.03	.....	
7,152	48,000	.04	.....	
7,450	50,000	.05	.....	
7,748	52,000	.06	.....	
8,046	54,000	.07	.....	
8,344	56,000	.09	.....	
8,642	58,000	.12	.....	
8,940	60,000	.18	.....	
8,960	60,130	.26	.....	Tensile strength.

Elongation of inch section, ″.46.
Exterior diameter at fracture, ″.76.
Appearance of fracture, silky.

No. 542[illegible].

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT NO. 226.

Marks, 1 A_3.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	0.	
5,215	35,000	.0013	.....	
5,960	40,000	.0014	0.	
6,407	43,000	.0016	.....	
6,705	45,000	.0018	.....	Elastic limit.
		.0023	.0006	
6,854	46,000	.0028	.....	
7,003	47,000	.0036	.....	
7,152	48,000	.0078	.....	
7,301	49,000	.0100	.....	
7,450	50,000	.0115	.0092	
7,599	51,000	.0124	.....	
7,748	52,000	.0132	.....	
7,897	53,000	.0157	.....	
8,046	54,000	.0169	.....	
8,195	55,000	.0194	.0169	
8,940	60,000	.03	.....	
9,536	64,000	.05	.....	
10,132	68,000	.09	.....	Cracks in surface.
10,180	68,320	.15	.....	Tensile strength.

Elongation of inch section, ″.35.
Exterior diameter at fracture, ″.81.
Appearance of fracture, silky. Opened numerous small cracks in cylindrical surface.

No. 5452.

ANNEALED ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 225.

Marks, 1 A_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0011	.....	
5,960	40,000	.0015	0.	
6,109	41,000	.0015	.....	
6,258	42,000	.0016	.....	Elastic limit. Load fell.
5,513	37,000	.0054	.....	
5,662	38,000	.0095	.....	
5,811	39,000	.0250	.....	
5,960	40,000	.0270	.0251	
6,556	44,000	.04	.....	
7,152	48,000	.06	.....	
7,748	52,000	.08	.....	
8,344	56,000	.12	....	
8,870	59,530	.25	.....	Tensile strength.

Elongation of inch section, ″.48.
Exterior diameter at fracture, ″.75.
Appearance of fracture, silky.

No. 5453.

ANNEALED ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 225.

Marks, 1 A_4.

Diameters, { exterior, 1″.-
interior, ″.900.

Sectional area, .149 square inch.

Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	0.	
5,960	40,000	.0015	.....	
6,109	41,000	.0016	.....	Elastic limit. Load fell.
5,364	36,000	.0085	.....	
5,513	37,000	.0093	.....	
5,662	38,000	.0102	.....	
5,811	39,000	.0220	.....	
5,960	40,000	.0262	.0244	
6,556	44,000	.04	.....	
7,152	48,000	.05	.....	
7,748	52,000	.08	.....	
8,344	56,000	.12	.....	
8,790	58,990	.24	.....	Tensile strength.

Elongation of inch section, ″.47.

Exterior diameter at fracture, ″.77.

Appearance of fracture, silky.

No. 5426.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 218.

Marks, 1 A_5.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0011	.....	
5,960	40,000	.0014	0.	
6,556	44,000	.0016	.....	Elastic limit.
6,705	45,000	.0320	.....	
7,152	48,000	.04	.....	
7,450	50,000	.05	.....	
7,748	52,000	.06	.....	
8,046	54,000	.07	.....	
8,344	56,000	.08	.....	
8,642	58,000	.10	.....	
8,940	60,000	.14	.....	
9,190	61,080	.25	.....	Tensile strength.

Elongation of inch section, ″.46.
Exterior diameter at fracture, ″.77.
Appearance of fracture, silky.

No. 5427.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 218.

Marks, 1 A_5.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.....	.....	
2,980	20,000	.....	.....	
4,170	30,000	.....	.....	
5,215	35,000	.....	.....	
5,590	37,520	.....	.....	Tensile strength.

Appearance of fracture, 40 per cent of surface silky, 60 per cent of surface dull smooth, representing the sides of cracks developed during the endurance test of the shaft.

The cracks then developed penetrated the full depth of the metal in this annular specimen; that is, the cracks are ″.05 deep, and probably were deeper.

No. 5430.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 244.

Marks, 1 B_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0011	.....	
5,960	40,000	.0015	0.	Elastic limit.
6,109	41,000	.0050	.....	Load fell.
5,662	38,000	.0106	.....	
5,811	39,000	.0176	.....	
5,960	40,000	.0204	.....	
6,109	41,000	.0220	.....	
6,258	42,000	.0246	.....	
6,407	43,000	.0270	.....	
6,556	44,000	.0294	.....	
7,450	50,000	.04	.....	
8,046	54,000	.07	.....	
8,642	58,000	.11	.....	
8,940	60,000	.16	.....	
9,030	60,620	.21	.....	Tensile strength.

Elongation of inch section, ″.44.
Exterior diameter at fracture, ″.77.
Appearance of fracture, silky.

No. 5431.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 244.

Marks, 1 B_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In guaged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0004	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0015	0.	
6,109	41,000	.0015	.....	Elastic limit.
6,258	42,000	.0019	.....	
6,407	43,000	.0021	.....	
6,556	44,000	.0024	.....	
6,705	45,000	.0036	.....	
6,854	46,000	.0062	.....	
7,003	47,000	.0087	.....	
7,152	48,000	.0101	.....	
7,301	49,000	.0118	.....	
7,450	50,000	.0130	.0109	
7,599	51,000	.0149	.....	
7,748	52,000	.0157	.....	
7,897	53,000	.0186	.....	
8,046	54,000	.0203	.....	
8,195	55,000	.0233	.....	
8,344	56,000	.0254	.....	
8,493	57,000	.0287	.....	
8,642	58,000	.0318	.0289	Cracks in sight.
8,820	59,190	.....	.....	Tensile strength.

Elongation of inch section, ″.12.
Exterior diameter at fracture, ″.96.
Appearance of fracture, silky. Opened numerous cracks in cylindrical surface. These cracks formed during the endurance test of the shaft, and penetrated the metal to a depth of ″.03 +.

No. 5450.

ANNEALED ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 251.

Marks, 1 B_3.
Diameters, { exterior, 1″. interior, ″.900
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0014	0.	
6,407	43,000	.0015	.....	Elastic limit. Load fell.
5,513	37,000	.0054	.....	
5,662	38,000	.0085	.....	
5,811	39,000	.0222	.....	
5,960	40,000	.0242	.0225	
6,556	44,000	.04	.....	
7,152	48,000	.05	.....	
7,748	52,000	.07	.....	
8,344	56,000	.10	.....	
8,940	60,000	.17	.....	
9,030	60,600	.23	.....	Tensile strength.

Elongation of inch section, ″.47
Exterior diameter at fracture, ″.76
Appearance of fracture, silky.

No. 5451.

ANNEALED ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT NO. 251.

Marks, 1 B_3.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0011	0.	
5,215	35,000	.0013	.....	
5,960	40,000	.0015	.0001	
6,109	41,000	.0016	.....	Elastic limit. Load fell.
5,364	36,000	.0050	.....	
5,513	37,000	.0075	.....	
5,662	38,000	.0120	.....	
5,811	39,000	.0220	.....	
5,960	40,000	.0237	.0221	
6,556	44,000	.03	.....	
7,152	48,000	.05	.....	
7,748	52,000	.07	.....	
8,344	56,000	.10	.....	
8,940	60,000	.16	.....	
9,040	60,670	.23	.....	Tensile strength.

Elongation of inch section, ″.46.
Exterior diameter at fracture, ″.77.
Appearance of fracture, silky.

No. 5448.

ANNEALED ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 272.

Marks, 1 B_6.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0005	.....	
4,470	30,000	.0008	0.	
5,960	40,000	.0012	0.	
6,705	45,000	.0013+	.....	
7,301	49,000	.0016	.....	Elastic limit. Load fell.
6,258	42,000	.0098	.....	
6,407	43,000	.0113	.....	
6,556	44,000	.0143	.....	
6,705	45,000	.0210	.....	
6,854	46,000	.0295	.....	
7,003	47,000	.0310	.....	
7,152	48,000	.0330	.....	
7,450	50,000	.04	.....	
7,748	52,000	.05	.....	
8,046	54,000	.06	.....	
8,344	56,000	.06+	.....	
8,642	58,000	.07	.....	
8,940	60,000	.08	.....	
9,238	62,000	.10	.....	
9,536	64,000	.13	.....	
9,834	66,000	.17	.....	
9,970	66,910	.23	.....	Tensile strength.

Elongation of inch section, ″.45.
Exterior diameter at fracture, ″.76.
Appearance of fracture, silky.

No. 5449.

ANNEALED ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 272.

Marks, 1 B_6.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	.0	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
3,725	30,000	.0010	.0001	
5,960	40,000	.0013	.0001	
6,705	45,000	.0016	.0001	
7,152	48,000	.0017	.....	Elastic limit. Load fell.
5,960	40,000	.0050	.....	
6,109	41,000	.0074	.....	
6,258	42,000	.0216	.....	
6,407	43,000	.0239	.....	
6,854	46,000	.03	.....	
7,152	48,000	.04	.....	
7,450	50,000	.04+	.....	
7,748	52,000	.05	.....	
8,046	54,000	.05+	.....	
8,344	56,000	.06	.....	
8,642	58,000	.07	.....	
8,940	60,000	.09	.....	
9,238	62,000	.10	.....	
9,536	64,000	.13	.....	
9,834	66,000	.17	.....	
9,885	66,340	.22	.....	Tensile strength.

Elongation of inch section, ″.46.
Exterior diameter at fracture, ″.76.
Appearance of fracture, silky.

No. 5432.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 245.

Marks, 2 B_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0013	0.	
6,705	45,000	.0015	.....	Elastic limit.
6,854	46,000	.0040	.....	Load fell.
6,109	41,000	.0071	.....	
6,258	42,000	.0087	.....	
6,407	43,000	.0136	.....	
6,556	44,000	.0168	.....	
6,705	45,000	.0200	.....	
6,854	46,000	.0211	.....	
7,003	47,000	.0225	.....	
7,152	48,000	.0241	.....	
7,301	49,000	.0262	.....	
7,450	50,000	.0281	.0260	
8,046	54,000	.04	.....	
8,642	58,000	.05	.....	
9,238	62,000	.07	.....	
9,834	66,000	.10	.....	
10,430	70,000	.16	.....	
10,440	70,070	.19	.....	Tensile strength.

Elongation of inch section, ″.44.
Exterior diameter at fracture, ″.77.
Appearance of fracture, silky.

No. 5433.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 245.

Marks, 2 B_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0005	.....	
4,470	30,000	.0009	.....	
5,215	35,000	.0012	.....	
5,811	39,000	.....	.....	Elastic limit (approximate).
5,960	40,000	.0019	.0006	
6,106	41,000	.0024	.....	
6,258	42,000	.0026	.....	
6,407	43,000	.0028	.....	
6,556	44,000	.0030	.....	
6,705	45,000	.0035	.0019	
6,854	46,000	.0039	.....	
7,003	47,000	.0044	.....	
7,152	48,000	.0049	.....	
7,301	49,000	.0059	.....	
7,450	50,000	.0073	.0053	
7,599	51,000	.0079	.....	
7,748	52,000	.0087	.....	
7,897	53,000	.0104	.....	
8,046	54,000	.0111	.....	
8,195	55,000	.0130	.0108	
8,344	56,000	.0149	.....	
8,493	57,000	.0156	.....	
8,642	58,000	.0170	.....	
8,791	59,000	.0195	.....	
8,940	60,000	.0210	.0186	
9,536	64,000	.03	.....	
10,132	68,000	.04	.....	
10,728	72,000	.08	.....	
11,070	74,290	.17	.....	Tensile strength.

Elongation of inch section, ″.35.
Exterior diameter at fracture, ″.83.
Appearance of fracture, silky. Three small surface cracks developed. Fracture began at one of them.

No. 5434.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT NO. 252.

Marks, 2 B_3.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0011	.....	
5,811	39,000	.....	.....	Elastic limit (approximate).
5,960	40,000	.0016	.0003	
6,109	41,000	.0020	.....	
6,258	42,000	.0022	.....	
6,407	43,000	.0027	.....	
6,556	44,000	.0037	.....	
6,705	45,000	.0161	.0140	
6,854	46,000	.0186	.....	
7,003	47,000	.0200	.....	
7,152	48,000	.0215	.....	
7,301	49,000	.0228	.....	
7,450	50,000	.0249	.0226	
8,046	54,000	.04	.....	
8,642	58,000	.05	.....	
9,238	62,000	.06	.....	
9,834	66,000	.08	.....	
10,430	70,000	.13	.....	
10,820	72,620	.24	.....	Tensile strength.

Elongation of inch section, ″.40.
Exterior diameter at fracture, ″.79.
Appearance of fracture, silky.

No. 5435.

ANGULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 252.

Marks, 2 B_3.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,215	35,000	.0012	.....	
5,960	40,000	.0019	.0006	
6,109	41,000	.0024	.....	
6,258	42,000	.0026	.....	
6,407	43,000	.0030	.....	
6,556	44,000	.0033	.....	
6,705	45,000	.0038	.0021	
6,854	46,000	.0043	.....	
7,003	47,000	.0050	.....	
7,152	48,000	.0056	.....	
7,301	49,000	.0065	.....	
7,450	50,000	.0074	.0054	
7,599	51,000	.0085	.....	
7,748	52,000	.0092	.....	
7,897	53,000	.0105	.....	
8,046	54,000	.0119	.....	
8,195	55,000	.0133	.0111	
8,344	56,000	.0142	.....	
8,493	57,000	.0160	.....	
8,642	58,000	.0176	.....	
8,791	59,000	.0497	.....	
8,940	60,000	.0215	.0191	
9,536	64,000	.03	.....	
10,132	68,000	.05	.....	
10,728	72,000	.08	.....	
11,190	75,100	.18	.....	Tensile strength.

Elongation of inch section, ″.37.
Exterior diameter at fracture, ″.80.
Appearance of fracture, silky.

No. 5436.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 259.

Marks, 2 B_c.
Diameter, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0014	0.	
6,556	44,000	.0016	.....	
6,705	45,000	.0020	.....	Elastic limit.
				Load fell.
6,407	43,000	.0120	.....	
6,556	44,000	.0166	.....	
6,705	45,000	.0202	.....	
6,854	46,000	.0210	.....	
7,003	47,000	.0224	.....	
7,152	48,000	.0238	.....	
7,301	49,000	.0263	.....	
7,450	50,000	.0280	.0260	
8,046	54,000	.04	.....	
8,642	58,000	.05	.....	
9,238	62,000	.07	.....	
9,834	66,000	.10	.....	
10,430	70,000	.17	.....	
10,480	70,340	.11	.....	Tensile strength.

Elongation of inch section, ″.42.
Exterior diameter at fracture, ″.78.
Appearance of fracture, silky.

No. 5437.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 259.

Marks, 2 B_c.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0010	.....	
5,215	35,000	.0014	.0001	
5,364	36,000	.0015	.....	
5,513	37,000	.0016	.....	Elastic limit.
5,662	38,000	.0021	.....	
5,811	39,000	.0024	.....	
5,960	40,000	.0026	.0010	
6,109	41,000	.0031	.....	
6,258	42,000	.0035	.....	
6,407	43,000	.0039	.....	
6,556	44,000	.0049	.....	
6,705	45,000	.0070	.0052	
6,854	46,000	.0078	.....	
7,003	47,000	.0095	.....	
7,152	48,000	.0110	.....	
7,301	49,000	.0129	.....	
7,450	50,000	.0140	.0120	Crack in sight.
7,599	51,000	.0163	.....	
7,748	52,000	.0174	.....	
7,897	53,000	.0194	.....	
8,046	54,000	.0210	.....	
8,195	55,000	.0239	.0216	
8,940	60,000	.04	.....	
9,536	64,000	.05	.....	
10,132	68,000	.08	.....	
10,728	72,000	.16	.....	Tensile strength.

Elongation of inch section, ″.22.
Exterior diameter at fracture, ″.86.
Appearance of fracture, silky. Opened minute cracks in the cylindrical surface. Fracture began at the crack first observed and tore apart in detail.

No. 5110.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 211.

Marks, 3 A_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	0.	
5,960	40,000	.0013	.....	
6,705	45,000	.0015	0.	
7,152	48,000	.0017	.....	
7,301	49,000	.0017	.....	Elastic limit.
7,450	50,000	.0021	.0004	
7,599	51,000	.0133	.....	
7,748	52,000	.0140	.....	
7,897	53,000	.0150	.....	
8,046	54,000	.0157	.....	
8,195	55,000	.0168	.0147	
8,344	56,000	.02	.....	
8,940	60,000	.03	.....	
9,536	64,000	.04—	.....	
10,132	68,000	.04	.....	
10,728	72,000	.05	.....	
11,324	76,000	.06	.....	
11,920	80,000	.08	.....	
12,516	84,000	.13	.....	
12,720	85,370	.19	.....	Tensile strength.

Elongation of inch section, ″.35.
Exterior diameter at fracture, ″.81.
Appearance of fracture, fine silky.

No. 5111.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 211.

Marks, 3 A_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0004	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	0.	
5,960	40,000	.0013	.....	
6,705	45,000	.0017	.0001	
7,152	48,000	.....	.....	Elastic limit (approximate).
7,450	50,000	.0023	.0006	
7,599	51,000	.0027	.....	
7,748	52,000	.0030	.....	
7,897	53,000	.0036	.....	
8,046	54,000	.0041	.....	
8,195	55,000	.0050	.0030	
8,344	56,000	.0057	.....	
8,642	58,000	.0080	.....	
8,940	60,000	.0100	.0077	
9,536	64,000	.02	.....	
10,132	68,000	.03	.....	
10,728	72,000	.03+	.....	
11,324	76,000	.04	.....	
11,920	80,000	.05	.....	
12,516	84,000	.07	.....	
13,112	88,000	.13	.....	
13,160	88,320	.19	.....	Tensile strength.

Elongation of inch section, ″.31.
Exterior diameter at fracture, ″.84.
Appearance of fracture, fine silky. Minute circumferential cracks developed.

No. 5114.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 223.

Marks, 3 A_3.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0015	0.	
6,705	45,000	.0017	.....	
7,450	50,000	.0020	.0002	Elastic limit.
7,599	51,000	.0031	.....	
7,748	52,000	.0094	.....	
7,897	53,000	.0170	.....	
8,046	54,000	.0180	.....	
8,195	55,000	.0187	.0064	
8,344	56,000	.02	.....	
8,940	60,000	.03	.....	
9,536	64,000	.04	.....	
10,132	68,000	.05	.....	
10,728	72,000	.06	.....	
11,324	76,000	.07	.....	
11,920	80,000	.08	.....	
12,516	84,000	.11	.....	
12,970	87,050	.20	.....	Tensile strength.

Elongation of inch section, ″.37.
Exterior diameter at fracture, ″.80.
Appearance of fracture, fine silky.

No. 5115.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 223.

Marks, 3 A_3.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0004	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	.....	
5,215	35,000	.0013	.0001	
5,960	40,000	.0017	.0003	
6,109	41,000	.0019	.....	
6,258	42,000	.0020	.....	
6,407	43,000	.0021	.....	
6,556	44,000	.0022	.....	
6,705	45,000	.0023	.0007	
6,854	46,000	.0025	.....	
7,003	47,000	.0027	.....	
7,152	48,000	.0028	.....	
7,301	49,000	.0029	.....	
7,450	50,000	.0030	.0011	
7,599	51,000	.0033	.....	
7,748	52,000	.0035	.....	
7,897	53,000	.0038	.....	
8,046	54,000	.0040	.....	
8,195	55,000	.0043	.0023	
8,344	56,000	.0047	.....	
8,493	57,000	.0050	.....	
8,642	58,000	.0053	.....	
8,791	59,000	.0059	.....	
8,940	60,000	.0064	.0041	Circumferential crack in sight.
9,536	64,000	.01	.....	
10,132	68,000	.02	.....	
10,728	72,000	.03	.....	
11,140	74,760	.04	.....	Tensile strength.

Elongation of inch section, ″.11.
Exterior diameter at fracture, ″.96.
Appearance of fracture, silky. Circumferential cracks developed. One dull spot extended through thickness of wall of specimen.

No. 5112.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT NO. 216.

Marks, 3 A_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0014	0.	
6,705	45,000	.0016	.....	
7,450	50,000	.0017	.....	
7,599	51,000	.0018	.....	
7,748	52,000	.0019	.....	
7,897	53,000	.0020	.....	Elastic limit.
		.0147	.....	
8,046	54,000	.0155	.....	
8,195	55,000	.0166	.0144	
8,344	56,000	.02	.....	
8,940	60,000	.02+	.....	
9,536	64,000	.03	.....	
10,132	68,000	.04	.....	
10,728	72,000	.05	.....	
11,324	76,000	.06	.....	
11,920	80,000	.07	.....	
12,516	84,000	.10	.....	
12,980	87,110	.19	.....	Tensile strength.

Elongation of inch section, ″.35.
Exterior diameter at fracture, ″.81.
Appearance of fracture, fine silky.

ENDURANCE OF ROTATING SHAFTS

FROM

STEEL BARS.

575

No. 5117.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 228.

Marks, 3 A_5.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
140	1,000	0.	.0	Initial load.
1,490	10,000	.0004	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0020	.....	Circumferential cracks developed ″.8 long.
5,310	35,640	.....	.....	Tensile strength.

Appearance of fracture: About 40 per cent silky, 60 per cent dull smooth. The silky metal represented that part of the sectional area which was intact before the test. The dull smooth metal represented fractured surfaces acquired during the endurance test.

No. 5456.

ANNEALED ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 232.

Marks, 3 A_6.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0013	0.	
6,705	45,000	.0015	.....	
7,450	50,000	.0017	0.	
8,195	55,000	.0019	0.	
8,940	60,000	.0020	0.	
9,536	64,000	.0022	.....	Elastic limit. Load fell.
8,642	58,000	.0063	.....	
8,791	59,000	.0078	.....	
8,940	60,000	.0124	.....	
9,089	61,000	.0200	.....	
9,238	62,000	.0235	.....	
9,387	63,000	.0245	.....	
9,536	64,000	.0248	.....	
9,685	65,000	.0257	.0229	
10,132	68,000	.03	.....	
10,728	72,000	.04	.....	
11,324	76,000	.05	.....	
11,920	80,000	.06	.....	
12,516	84,000	.08	.....	
13,112	88,000	.10	.....	
13,708	92,000	.14	.....	
13,970	93,760	.22	.....	Tensile strength.

Elongation of inch section, ″.39.
Exterior diameter at fracture, ″.81.
Appearance of fracture, silky.

No. 5457.

ANNEALED ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 232.

Marks, 3 A_6.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0005	.....	
4,470	30,000	.0008	.....	
5,960	40,000	.0011	0.	
6,705	45,000	.0013	.....	
7,450	50,000	.0015	0.	
8,195	55,000	.0017	0.	Elastic limit.
8,344	56,000	.0020	.....	
8,493	57,000	.0025	.....	
8,642	58,000	.0086	.....	
8,791	59,000	.0187	.....	
8,940	60,000	.0197	.....	
10,132	68,000	.03	.....	
10,728	72,000	.04	.....	
11,324	76,000	.05	.....	
11,920	80,000	.06	.....	
12,516	84,000	.08	.....	
13,112	88,000	.10	.....	
13,540	90,870	.20	.....	Tensile strength.

Elongation of inch section, ″.36.
Exterior diameter at fracture, ″.81.
Appearance of fracture, silky.

No. 5118.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 241.

Marks, 3 B_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0013	.....	
7,450	50,000	.0017	0.	
7,599	51,000	.0017	.....	
7,748	52,000	.0018	.....	
7,897	53,000	.0018	.....	Elastic limit.
8,046	54,000	.0020 .0136	.....	
8,195	55,000	.0148	.0128	
8,344	56,000	.02—	.....	
8,940	60,000	.02	.....	
9,536	64,000	.03	.....	
10,132	68,000	.03+	.....	
10,728	72,000	.04	.....	
11,324	76,000	.05	.....	
11,920	80,000	.06	.....	
12,516	84,000	.08	.....	
13,112	88,000	.11	.....	
13,460	90,330	.17	.....	Tensile strength.

Elongation of inch section, ″.36.
Exterior diameter at fracture, ″.81.
Appearance of fracture, fine silky.

No. 5119.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 241.

Marks, 3 B_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0008	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	0.	
5,960	40,000	.0012	0.	
6,705	45,000	.0015	.....	
6,854	46,000	.0015	.....	
7,003	47,000	.0016	.....	
7,152	48,000	.0017	.....	
7,301	49,000	.0019	.....	
7,450	50,000	.0021	.0004	
7,599	51,000	.0023	.....	
7,748	52,000	.0025	.....	
7,897	53,000	.0027	.....	
8,046	54,000	.0030	.....	
8,195	55,000	.0043	.0023	
8,344	56,000	.0054	.....	
8,493	57,000	.0070	.....	
8,642	58,000	.0081	.....	
8,791	59,000	.0092	.....	
8,940	60,000	.0103	.0080	
9,536	64,000	.02—	.....	
10,132	68,000	.02	.....	
10,728	72,000	.03	.....	
11,324	76,000	.03+	.....	
11,920	80,000	.04	.....	
12,516	84,000	.06	.....	
13,112	88,000	.08	.....	
13,708	92,000	.16	.....	Tensile strength.

Elongation of inch section, ″.32.
Exterior diameter at fracture, ″.82.
Appearance of fracture, silky.

No. 5454.

ANNEALED ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 246.

Marks, 3 B_2.
Diameter, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0014	0.	
6,705	45,000	.0016	.....	
7,450	50,000	.0018	0.	
8,195	55,000	.0020	.....	
8,791	59,000	.0022	.....	Elastic limit. Load fell.
8,344	56,000	.0035	.....	
8,493	57,000	.0069	.....	
8,642	58,000	.0101	.....	
8,791	59,000	.0145	.....	
8,940	60,000	.0200	.0175	
9,536	64,000	.03	.....	
10,132	68,000	.03+	.....	
10,728	72,000	.04	.....	
11,324	76,000	.05	.....	
11,920	80,000	.06	.....	
12,516	84,000	.07	.....	
13,112	88,000	.10	.....	
13,708	92,000	.15	.....	
13,820	92,750	.24	.....	Tensile strength.

Elongation of inch section, ″.35.
Exterior diameter at fracture, ″.81.
Appearance of fracture, silky.

BETHLEHEM IRON COMPANY'S NICKEL STEEL, ANNEALED. MARKS 7×3 S.

Turned down from rod 1¼″ diameter. 0.29 per cent carbon, 5.661 per cent nickel.
Diameter, 1″. Speed of rotation, 1,500 per minute.
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2007	.1666	.2005	.0339	.0002	
			b	.2009	.1667	.2007	.0340	.0002	
			c	.2010	.1668	.2007	.0339	.0003	
	10,000	10,000	*a*	.2007	.1669	.2004	.0335	.0003	
			b	.2006	.1668	.2004	.0336	.0002	
			c	.2008	.1668	.2003	.0335	.0005	
	117,800	127,800							Rested 39 hours.
	0	127,800	*a*	.2007	.1669	.2005	.0336	.0002	
			b	.2007	.1668	.2004	.0336	.0003	
			c	.2005	.1669	.2005	.0336	0.	
	677,500	805,300							Rested 15 hours.
	0	805,300	*a*	.2008	.1670	.2006	.0336	.0002	
			b	.2010	.1669	.2006	.0337	.0004	
			c	.2010	.1670	.2006	.0336	.0004	
	670,700	1,476,000							Do.
	0	1,476,000	*a*	.2006	.1670	.2006	.0336	0.	
			b	.2008	.1670	.2008	.0338	0.	
			c	.2010	.1670	.2007	.0337	.0003	
	669,400	2,145,400							Do.
	0	2,145,400	*a*	.2009	.1668	.2007	.0339	.0002	
			b	.2010	.1670	.2007	.0337	.0003	
			c	.2010	.1670	.2009	.0339	.0001	
	672,200	2,817,600							Do.
	0	2,817,600	*a*	.2009	.1670	.2006	.0336	.0003	
			b	.2010	.1670	.2008	.0338	.0002	
			c	.2010	.1669	.2008	.0339	.0002	
	681,900	3,499,500							Do.
	0	3,499,500	*a*	.2009	.1669	.2007	.0338	.0002	
			b	.2009	.1671	.2007	.0336	.0002	
			c	.2010	.1671	.2008	.0337	.0002	
	679,400	4,178,900							Rested 39 hours.
	0	4,178,900	*a*	.2009	.1670	.2007	.0337	.0002	
			b	.2010	.1672	.2008	.0336	.0002	
			c	.2010	.1670	.2008	.0338	.0002	
	189,500	4,368,400							Shaft ruptured at the north edge of south middle bearing.

BETHLEHEM IRON COMPANY'S NICKEL STEEL, ANNEALED. MARKS, 7×3 H

Turned down from rod 1¼″ diameter. 0.29 pe
per cent nickel.
Diameter, 1″. Speed of rotation, 1,500 per min
Length between end supports, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.		
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*I*
40,000	0	0	*a*	0.2012	0.1681	0.2005	0.0324	0.
			b	.2009	.1684	.2007	.0323	.
			c	.2008	.1683	.2006	.0323	.
	10,000	10,000	*a*	.2008	.1679	.2008	.0329	0.
			b	.2012	.1681	.2011	.0330	.
			c	.2012	.1680	.2010	.0330	.
	551,300	561,300						
	0	561,300	*a*	.2012	.1679	.2010	.0331	.
			b	.2014	.1686	.2012	.0326	.
			c	.2012	.1682	.2010	.0328	.
	647,400	1,208,700						
	0	1,208,700	*a*	.2010	.1680	.2009	.0330	.
			b	.2012	.1683	.2010	.0327	.
			c	.2010	1683	.2010	.0327	0.
	659,000	1,867,700						
	0	1,867,700	*a*	.2011	.1683	.2010	.0327	.
			b	.2013	.1684	.2010	.0326	.
			c	.2011	.1682	.2010	.0328	.
	680,000	2,547,700						
	0	2,547,700	*a*	.2009	.1684	.2007	.0323	.
			b	.2012	.1684	.2010	.0326	.
			c	.2012	.1682	.2009	.0327	.
	694,200	3,241,900						
	0	3,241,900	*a*	.2008	.1683	.2008	.0325	0.
			b	.2014	.1687	.2011	.0327	.
			c	.2012	.1685	.2010	.0325	.
	553,200	3,795,200						

No. 5439.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 253.

Marks, 3 B_3.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0013	.0001	
6,705	45,000	.0017	.0002	
7,450	50,000	.0022	.0005	
7,599	51,000	.0025	.....	
7,748	52,000	.0026	.....	
7,897	53,000	.0028	.....	
8,046	54,000	.0030	.....	
8,195	55,000	.0033	.0014	
8,344	56,000	.0036	.....	
8,493	57,000	.0039	.....	
8,642	58,000	.0041	.....	
8,791	59,000	.0045	.....	
8,940	60,000	.0052	.0031	
9,238	62,000	.0063	.....	
9,536	64,000	.0080	.....	
9,834	66,000	.0104	.....	
10,132	68,000	.0117	.....	
10,430	70,000	.0137	.0110	
10,579	76,000	.02	.....	
11,920	80,000	.03	.....	
12,516	84,000	.04	.....	
13,112	88,000	.05	.....	
13,708	92,000	.07	.....	
14,270	95,770	.15	.....	Tensile strength.

Elongation of inch section, ″.32.
Exterior diameter at fracture, ″.82.
Appearance of fracture. silky.

No. 5440.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 275.

Marks, 3 B_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0005	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0012	0.	
7,450	50,000	.0017	0.	Elastic limit.
7,599	51,000	.0125	.....	
7,748	52,000	.0142	.....	
7,897	53,000	.0151	.....	
8,046	54,000	.0156	.....	
8,195	55,000	.0172	.0150	
8,344	56,000	.0181	.....	
8,493	57,000	.0191	.....	
8,642	58,000	.0200	.....	
8,791	59,000	.0216	.....	
8,940	60,000	.0234	.0208	
9,536	64,000	.03	.....	
10,132	68,000	.04	.....	
10,728	72,000	.05	.....	
11,324	76,000	.06	.....	
11,920	80,000	.08	.....	
12,516	84,000	.11	.....	
12,970	87,050	.21	.....	Tensile strength.

Elongation of inch section, ″.31.
Exterior diameter at fracture, ″.83.
Appearance of fracture, silky.

No. 5441.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 275.

Marks, 3 B_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0013	0.	
6,705	45,000	.0015	.....	
7,450	50,000	.0018	.0001	
7,897	53,000	.0019	.....	
8,046	54,000	.0020	.....	Elastic limit.
8,195	55,000	.0044	.0025	
8,344	56,000	.0094	.....	
8,493	57,000	.0115	.....	
8,642	58,000	.0125	.....	
8,791	59,000	.0135	.....	
8,940	60,000	.0145	.0121	
9,238	62,000	.0166	.....	
9,536	64,000	.0191	.....	
9,834	66,000	.0214	.....	
10,132	68,000	.0250	.....	
10,430	70,000	.0275	.0245	
11,324	76,000	.04	.....	
11,920	80,000	.05	.....	
12,516	84,000	.07	.....	
13,112	88,000	.09	.....	
13,510	90,670	.17	.....	Tensile strength.

Elongation of inch section, ″.36.
Exterior diameter at fracture, ″.81.
Appearance of fracture, silky.

No. 5120.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT NO. 207.

Marks, 5 A_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0013	0.	
7,450	50,000	.0017	0.	
7,599	51,000	.0018	.....	
7,748	52,000	.0018	.....	Elastic limit.
7,897	53,000	.0085	.....	
8,046	54,000	.0088	.....	
8,195	55,000	.0095	.0071	
8,344	56,000	.0100	.....	
8,493	57,000	.0104	.....	
8,642	58,000	.0111	.....	
8,791	59,000	.0115	.....	
8,940	60,000	.0121	.0094	
9,536	64,000	.02	.....	
10,132	68,000	.02+	.....	
10,728	72,000	.03	.....	
11,324	76,000	.03+	.....	
11,920	80,000	.04	.....	
12,516	84,000	.04+	.....	
13,112	88,000	.05	.....	
13,708	92,000	.06	.....	
14,304	96,000	.08	.....	}
14 900	100,000	{ .14 .16	.....	} Tensile strength.

Elongation of inch section, ″.29.
Exterior diameter at fracture, ″.84.
Appearance of fracture, silky.

No. 5121.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 207.

Marks, 5 A_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1, 000	0.	0.	Initial load.
1, 490	10, 000	.0003	.....	
2, 980	20, 000	.0006	.....	
4, 470	30. 000	.0009	.....	
5, 960	40, 000	.0012	0.	
6, 705	45, 000	.0016	.....	
7, 450	50, 000	.0019	.0002	
8, 195	55, 000	.0024	.0005	
8, 344	56, 000	.0026	.....	
8, 493	57, 000	.0028	.....	
8, 642	58, 000	.0029	.....	
8, 791	59, 000	.0031	.....	
8, 940	60, 000	.0032	.0010	
9, 089	61, 000	.0036	.....	
9, 238	62, 000	.0039	.....	
9, 387	63, 000	.0042	.....	
9, 536	64, 000	.0047	.....	
9, 685	65, 000	.0056	.0031	
9, 834	66, 000	.0062	.....	
9, 983	67, 000	.0070	.....	
10, 132	68, 000	.0077	.....	
10, 281	69, 000	.0087	.....	
10, 430	70, 000	.0093	.0066	
11, 026	74, 000	.02—	.....	
11, 622	78, 000	.02	.....	
12, 218	82. 000	.03—	.....	
12, 814	86, 000	.03	.....	
13, 410	90, 000	.04—	.....	
14, 006	94, 000	.04	.....	
14, 602	98, 000	.05	.....	
14, 900	100, 000	.06—	.....	
15, 496	104, 000	.07—	.....	
16, 092	108, 000	.08	.....	
16, 610	111, 480	.15	.....	Tensile strength.

Elongation of inch section, ″.27.
Exterior diameter of fracture, ″.87.
Appearance of fracture, silky.

No. 5102.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 208.

Marks, 5 A_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0001	.....	
2,980	20,000	.0003	.....	
4,470	30,000	.0006	0.	
5,215	35,000	.0009	.....	
5,960	40,000	.0010	0.	
6,705	45,000	.0011	.....	
7,450	50,000	.0012	.0001	
7,599	51,000	.0013	.....	
7,748	52,000	.0013	.....	Elastic limit.
7,897	53,000	.0018	.....	
8,046	54,000	.0061	.....	
8,195	55,000	.0088	.....	
8,344	26,000	.0089	.....	
8 493	57,000	.0091	.....	
8,642	58,000	.0095	.....	
8,791	59,000	.0101	.....	
8,940	60,000	.0110	.0086	
9,089	61,000	.0117	.....	
9,238	62,000	.0121	.....	
9,387	63,000	.0129	.....	
9,536	64,000	.0137	.....	
9,685	65,000	.0144	.0120	
9,834	66,000	.0155	.....	
9,983	67,000	.0162	.....	
10,132	68,000	.0171	.....	
10,430	70,000	.02	.....	
10,728	72,000	.02	.....	
11,026	74,000	.02	.....	
11,324	76,000	.02	.....	
11,622	78,000	.03	.....	
13,112	88,000	.04	.....	
14,006	94,000	.05	.....	
14,304	96,000	.07	.....	
14,602	98,000	.08	.....	
14,900	100,000	.10	.....	
15,098	101,330	.20	.....	Tensile strength.

Elongation of inch section, ″.28.
Exterior diameter at fracture, ″.84.
Appearance of fracture, silky.

No. 5103.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 208.

Marks, 5 A_2.
Diameters, { exterior, 1″. interior, ″.900
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	0.	
2,980	20,000	.0006	0.	
4,470	30,000	.0009	0.	
5,215	35,000	.0011	.....	
5,960	40,000	.0013	.....	
6,705	45,000	.0016	0.	
7,450	50,000	.0018	0.	
8,940	60,000	.0023	.0002	
9,089	61,000	.0024	.....	
9,238	62,000	.0025	.....	
9,387	63,000	.0025	.....	
9,536	64,000	.0026	.....	
9,685	65,000	.0027	.0003	
9,834	66,000	.0028	.....	
9,983	67,000	.0028	.....	
10,132	68,000	.0028	.....	
10,281	69,000	.0029	.....	
10,430	70,000	.0030	.0004	
10,579	71,000	.0032	.....	
10,728	72,000	.0032	.....	
10,877	73,000	.0034	.....	
11,026	74,000	.0034	.....	
11,175	75,000	.0036	.0006	
11,324	76,000	.0037	.....	
11,473	77,000	.0039	.0008	Snapping sounds; circumferential cracks in sight.
11,520	77,320	.....	.....	Tensile strength.

No appreciable contraction of diameter.

Appearance of fracture granular; dull-colored spots on fractured surface, some of which extend across the annular surface.

No. 5122.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 215.

Marks, 5 A_3.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0014	0.	
7,450	50,000	.0019	0.	
7,599	51,000	.0020	.....	
7,748	52,000	.0021	.....	Elastic limit.
7,897	53,000	.0060	.....	
8,046	54,000	.0082	.....	
8,195	55,000	.0090	.0066	
8,344	56,000	.0095	.....	
8,493	57,000	.0100	.....	
8,642	58,000	.0106	.....	
8,791	59,000	.0113	.....	
8,940	60,000	.0119	.0093	
9,238	62,000	.0134	.....	
9,536	64,000	.0150	.....	
9,834	66,000	.0169	.....	
10,132	68,000	.0186	.....	
10,430	70,000	.0202	.0168	
11,026	74,000	.03—	.....	
11,622	78,000	.03+	.....	
12,218	82,000	.04	.....	
12,814	86,000	.04+	.....	
13,410	90,000	.05	.....	
14,006	94,000	.07	.....	
14,602	98,000	.08	.....	
14,900	100,000	.10	.....	
15,270	102,480	.17	.....	Tensile strength.

Elongation of inch section, ″.27.
Exterior diameter at fracture, ″.86.
Appearance of fracture, silky.

No. 5123.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 215.

Marks, 5 A_3.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0013	.0001	
6,705	45,000	.0016	.....	
7,450	50,000	.0020	.0002	
8,195	55,000	.0024	.0005	
8,344	56,000	.0026	.....	
8,493	57,000	.0028	.....	
8,642	58,000	.0029	.....	
8,791	59,000	.0031	.....	
8,940	60,000	.0036	.0013	
9,089	61,000	.0042	.....	
9,238	62,000	.0046	.....	
9,387	63,000	.0052	.....	
9,536	64,000	.0058	.....	
9,685	65,000	.0068	.0042	
9,834	66,000	.0075	.....	
10,132	68,000	.0087	.....	
10,430	70,000	.0101	.0072	
10,728	72,000	.0120	.....	
11,026	74,000	.0135	.....	
11,324	76,000	.0154	.....	
11,622	78,000	.0171	.....	
11,920	80,000	.0194	.0157	
12,516	84,000	.03—	.....	
13,112	88,000	.03	.....	
13,708	92,000	.04	.....	
14,304	96,000	.05	.....	
14,900	100,000	.06	.....	
15,496	104,000	.07	.....	
16,092	108,000	.13	.....	Tensile strength..

Elongation of inch section, ″.22.
Exterior diameter at fracture, ″.90.
Appearance of fracture, silky. Opened four minute cracks in the cylindrical surface. Fracture began at one of these places.

No. 5124.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT NO. 222.

Marks, 5 A_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0014	0.	
7,450	50,000	.0018	0.	
7,599	51,000	.0019	.....	
7,748	52,000	.0020	.....	
7,897	53,000	.0021	.....	
8,046	54,000	.0022	.....	
8,195	55,000	.0093	.0070	
8,344	56,000	.0100	.....	
8,493	57,000	.0103	.....	
8,642	58,000	.0107	.....	
8,791	59,000	.0113	.....	
8,940	60,000	.0120	.0092	
9,238	62,000	.0133	.....	
9,536	64,000	.0148	.....	
9,834	66,000	.0163	.....	
10,132	68,000	.0181	.....	
10,430	70,000	.0198	.0166	
11,026	74,000	.03—	.....	
11,622	78,000	.03	.....	
12,218	82,000	.04	.....	
12,814	86,000	.04+	.....	
13,410	90,000	.05	.....	
14,006	94,000	.06	.....	
14,602	98,000	.08	.....	
14,900	100,000	.09	.....	
15,250	102,350	.16	.....	Tensile strength.

Elongation of inch section, ″.29.
Exterior diameter at fracture, ″.84.
Appearance of fracture, silky.

No. 5125.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 222.

Marks, 5 A_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0004	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0015	.0001	
6,705	45,000	.0018	.....	
7,450	50,000	.0023	.0004	
7,599	51,000	.0025	.....	
7,748	52,000	.0026	.....	
7,897	53,000	.0028	.....	
8,046	54,000	.0029	.....	
8,195	55,000	.0032	.0011	
8,344	56,000	.0037	.....	
8,493	57,000	.0039	.....	
8,642	58,000	.0041	.....	
8,791	59,000	.0046	.....	
8,990	60,000	.0051	.0027	
9,238	62,000	.0061	.....	
9,536	64,000	.0073	.....	
9,834	66,000	.0088	.....	
10,132	68,000	.0103	.....	
10,430	70,000	.0119	.0088	
10,728	72,000	.0133	.....	
11,026	74,000	.0149	.....	
11,324	76,000	.0166	.....	
11,622	78,000	.0180	.....	Circumferential cracks in sight.
11,920	80,000	.02+	.....	
12,516	84,000	.03—	.....	
12,980	87,110	.....	.....	Tensile strength.

Elongation of inch section, ″.06.
Exterior diameter at fracture, ″.98.
Appearance of fracture, in part silky, and in part dull smooth surface representing places of ruptured metal acquired during the endurance test.

No. 5126.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 229.

Marks, 5 A_5.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0013	0.	
7,450	50,000	.0017	0.	
7,599	51,000	.0017	.....	
7,748	52,000	.0018	.....	
7,897	53,000	.0019	.....	
8,046	54,000	.0019	.....	
8,195	55,000	.0020	0.	Elastic limit.
8,344	56,000	.0089	.....	
8,493	57,000	.0094	.....	
8,642	58,000	.0096	.....	
8,791	59,000	.0104	.....	
8,940	60,000	.0109	.0083	
9,238	62,000	.0122	.....	
9,536	64,000	.0137	.....	
9,834	66,000	.0152	.....	
10,132	68,000	.0169	.....	
10,430	70,000	.0186	.0154	
11,026	74,000	.03—	.....	
11,622	78,000	.03	.....	
12,218	82,000	.04—	.....	
12,814	86,000	.04	.....	
13,410	90,000	.05	.....	
14,006	94,000	.06	.....	
14,602	98,000	.07	.....	
14,900	100,000	.08	.....	
15,460	103,760	.13	.....	Tensile strength.

Elongation of inch section, ″.28.
Exterior diameter at fracture, ″.85.
Appearance of fracture, silky.

No. 5127.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 29.

Marks, 5 A_5.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0013	0.	
6,705	45,000	.0016	.....	
7,450	50,000	.0020	.0002	
7,599	51,000	.0022	.....	
7,748	52,000	.0025	.....	
7,897	53,000	.0028	.....	
8,046	54,000	.0032	.....	
8,195	55,000	.0040	.0019	
8,344	56,000	.0044	.....	
8,493	57,000	.0047	.....	
8,642	58,000	.0053	.....	
8,791	59,000	.0060	.....	
8,940	60,000	.0067	.0043	
9,238	62,000	.0080	.....	
9,536	64,000	.0092	.....	
9,834	66,000	.0107	.....	
10,132	68,000	.0123	.....	
10,430	70,000	.0139	.0109	
11,026	74,000	.02	.....	
11,622	78,000	.03—	.....	
12,218	82,000	.03	.....	
12,814	86,000	.03 +	.....	
13,410	90,000	.04	.....	
14,006	94,000	.05	.....	
14,602	98,000	.06	.....	
15,198	102,000	.08	.....	
15,794	106,000	.10	.....	Tensile strength.

Elongation of inch section, ″.28.
Exterior diameter at fracture, ″.84.
Appearance of fracture, silky.

No. 5460.

ANNEALED ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 233.

Marks, 5 A_6.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0005	.....	
4,470	30,000	.0008	.....	
5,960	40,000	.0012	0.	
7,450	50,000	.0016	0.	
8,195	55,000	.0018	.....	
8,940	60,000	.0020	0.	
9,685	65,000	.0022	0.	Elastic limit.
10,430	70,000	.0023	0.	
10,579	71,000	.0027	.....	
				Load fell.
10,281	69,000	.0048	.....	
10,579	71,000	.0128	.....	
10,728	72,000	.0131	.....	
10,877	73,000	.0134	.....	
11,026	74,000	.0138	.....	
11,324	76,000	.0154	.....	
11,622	78,000	.0166	.....	
11,920	80,000	.0181	.0146	
13,112	88,000	.03	.....	
14,304	96,000	.04	.....	
15,496	104,000	.05	.....	
16,688	112,000	.07	.....	
17,780	119,330	.14	.....	Tensile strength.

Elongation of inch section, ″.28.
Exterior diameter at fracture, ″.85.
Appearance of fracture, silky.

No. 5461.

ANNEALED ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT NO. 233.

Marks, 5 A_6.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0014	0.	
7,450	50,000	.0017	.....	
8,940	60,000	.0021	0.	
9,685	65,000	.0023	0.	Elastic limit.
9,834	66,000	.0052	.....	
9,983	67,000	.0064	.....	
10,132	68,000	.0081	.....	
10,281	69,000	.0105	.....	
10,430	70,000	.0113	.0081	
10,728	72,000	.0124	.....	
11,026	74,000	.0137	.....	
11,324	76,000	.0152	.....	
11,622	78,000	.0168	.....	
11,920	80,000	.0184	.0147	
13,112	88,000	.03	.....	
14,304	96,000	.04	.....	
15,496	104,000	.05	.....	
16,688	112,000	.07	.....	
17,370	116,580	.14	.....	Tensile strength.

Elongation of inch section, ″.30.
Exterior diameter at fracture, ″.85.
Appearance of fracture, silky.

No. 5458.

ANNEALED ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 247.

Marks, 5 B_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0005	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0013	0.	
6,705	45,000	.0015	.....	
7,450	50,000	.0016	0.	
8,195	55,000	.0018	0.	
8,940	60,000	.0020	0.	
9,685	65,000	.0022	0.	
9,983	67,000	.0023	.....	Elastic limit. Load fell.
9,536	64,000	.0040	.....	
9,685	65,000	.0053	.....	
9,834	66,000	.0084	.....	
9,983	67,000	.0095	.....	
10,132	68,000	.0115	.....	
10,281	69,000	.0123	.....	
10,430	70,000	.0127	.0096	
10,728	72,000	.0137	.....	
11,026	74,000	.0157	.....	
11,324	76,000	.0176	.....	
11,622	78,000	.0183	.....	
11,920	80,000	.0205	.0169	
13,112	88,000	.03	.....	
14,304	96,000	.04	.....	
15,496	104,000	.06	.....	
16,688	112,000	.11	.....	
16,720	112,210	.15	.....	Tensile strength.

Elongation of inch section, ″.29.
Exterior diameter at fracture, ″.84.
Appearance of fracture, silky.

No. 5459.

ANNEALED ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT NO. 247.

Marks, 5 B_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Guaged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	0.	
5,960	40,000	.0012	.....	
6,705	45,000	.0014	.....	
7,450	50,000	.0017	0.	
8,195	55,000	.0019	0.	
8,940	60,000	.0020	0.	
9,685	65,000	.0022	0.	
9,834	66,000	.0023	.....	
9,983	67,000	.0023	.....	Elastic limit. Load fell.
9,536	64,000	.0036	.....	
9,685	65,000	.0060	.....	
9,834	66,000	.0076	.....	
9,983	67,000	.0085	.....	
10,132	68,000	.0137	.....	
10,281	69,000	.0140	.....	
10,430	70,000	.0146	.0115	
10,728	72,000	.0161	.....	
11,026	74,000	.0175	.....	
11,324	76,000	.0196	.....	
11,622	78,000	.0212	.....	
11,920	80,000	.0234	.0197	
13,112	88,000	.03	.....	
14,304	96,000	.04	.....	
15,496	104,000	.07	.....	
16,340	109,660	.16	.....	Tensile strength.

Elongation of inch section, ″.28.
Exterior diameter at fracture, ″.87.
Appearance of fracture, silky.

No. 5131.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 240.

Marks, 5 B_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0013	0.	
7,450	50,000	.0016	0.	
8,195	55,000	.0018	.....	Elastic limit.
		.0023	.0005	
8,344	56,000	.0075	.....	
8,493	57,000	.0083	.....	
8,642	58,000	.0087	.....	
8,791	59,000	.0091	.....	
8,940	60,000	.0099	.0076	
9,238	62,000	.0111	.....	
9,536	64,000	.0127	.....	
9,834	66,000	.0144	.....	
10,132	68,000	.0156	.....	
10,430	70,000	.0171	.0141	
11,026	74,000	.03	.....	
11,622	78,000	.03	.....	
12,218	82,000	.03	.....	
12,814	86,000	.04	.....	
13,410	90,000	.04+	.....	
14,006	94,000	.05	.....	
14,602	98,000	.07	.....	
15,198	102,000	.09	.....	
15,780	105,910	.16	.....	Tensile strength.

Elongation of inch section, ″.30.
Exterior diameter at fracture, ″.84.
Appearance of fracture, silky.

No. 5132.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 240.

Marks, 5 B_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0008	.....	
5,960	40,000	.0013	.0001	
6,705	45,000	.0018	.0003	
7,450	50,000	.0024	.0006	
7,599	51,000	.0027	.....	
7,748	52,000	.0028	.....	
7,897	53,000	.0031	.....	
8,046	54,000	.0035	.....	
8,195	55,000	.0038	.0018	
8,344	56,000	.0044	.....	
8,493	57,000	.0048	.....	
8,642	58,000	.0050	.....	
8,791	59,000	.0056	.....	
8,940	60,000	.0061	.0038	
9,238	62,000	.0072	.....	
9,536	64,000	.0083	.....	
9,834	66,000	.0097	.....	
10,132	68,000	.0111	.....	
10,430	70,000	.0127	.0097	
11,026	74,000	.02	.....	
11,622	78,000	.02+	.....	
12,218	82,000	.03	.....	
12,814	86,000	.03+	.....	
13,410	90,000	.04	.....	
14,006	94,000	.05	.....	
14,602	98,000	.05+	.....	
15,198	102,000	.07	.....	
15,794	106,000	.10	.....	
16,030	107,580	.16	.....	Tensile strength.

Elongation of inch section, ″.28.
Exterior diameter at fracture, ″.84.
Appearance of fracture, silky.

	do	7 A_3	.733	100	52,460	92,350	7882	154,700	7883	154,400			
214	do	7 B_1	.733		55,000	117,000	5135	149,930	5136	151,740	1,810		
269	do	7 A_1	.733		60,000	218,500	5104	148,660	5105	150,000	1,340		
198	do	7 A_2	.733		60,000	34,900	5133	144,830	5134	154,700	0,870		
199	do	9 A_5	.824		40,000	269,500	5412	139,530	5413	135,440			4,
248	do	9 B_1	.824		40,000	481,300	5414	149,190	5415	142,280			6,
249	do	9 A_6	.824		45,000	174,400	5410	141,070	5411	137,250			3,
235	do	9 B_2	.824		45,000	190,000	7884	155,570	7885	144,360			11,
255	do	9 A_4	.824		50,000	103,100	7886	133,420	7887	138,790	5,370		
220	do	9 B_5	.824		50,000	314,600	5408	154,700	5409	158,320	3,620		
263	do	9 A_3	.824		52,460	116,500	7888	146,240	7889	145,910			
213	do	9 B_3	.824		55,000	100,300	5148	152,620	5149	158,250	5,630		
270	do	9 A_1	.824		60,000	148,200	5106	138,660	5107	114,760			23,
200	do	11 A_5	1.094		40,000	162,400	5422	140,000	5423	142,680	2,680		
237	do	11 B_1	1.094		40,000	466,350	5424	146,780	5425	151,540	4,760		
250	do	11 A_6	1.094		45,000	81,150	7890	138,660	7891	143,220	4,560		
236	do	11 B_2	1.094		45,000	101,500	5420	145,500	5421	147,520	2,020		
256	do	11 A_4	1.094		50,000	159,550	7892	139,060	7893	79,190			59,
219	do	11 B_5	1.094		50,000	130,100	5418	145,100	5419	144,700			
264	do	11 A_3	1.094		52,460	29,500	7894	145,230	7895	141,210			4,
212	do	11 B_3	1.094		55,000	48,300	5416	146,440	5417	144,500			1,
271	do	11 A_1	1.094		60,000	99,200	5108	135,330	5109	154,230	18,900		
202	do												

* Specimens annealed before testing.

No. 5445.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 254.

Marks, 5 B_3.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0005	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0013	.0001	
6,705	45,000	.0017	.0002	
7,450	50,000	.0022	.0005	
7,599	51,000	.0023	.....	
7,748	52,000	.0025	.....	
7,897	53,000	.0027	.....	
8,046	54,000	.0029	.....	
8,195	55,000	.0034	.0015	
8,344	56,000	.0037	.....	
8,493	57,000	.0042	.....	
8,642	58,000	.0045	.....	
8,791	59,000	.0049	.....	
8,940	60,000	.0056	.0035	
9,238	62,000	.0065	.....	
9,536	64,000	.0077	.....	
9,834	66,000	.0091	.....	
10,132	68,000	.0105	.....	
10,430	70,000	.0122	.0093	
10,728	72,000	.0133	.....	
11,026	74,000	.0147	.....	
11,324	76,000	.0166	.....	
11,622	78,000	.0183	.....	
11,920	80,000	.0206	.0173	
13,112	88,000	.03	.....	
13,708	92,000	.04	.....	
14,304	96,000	.05	.....	
14,900	100,000	.06	.....	
15,496	104,000	.08	.....	
16,092	108,000	.11	.....	
16,180	108,590	.17	.....	Tensile strength.

Elongation of inch section, ″.29.
Exterior diameter at fracture, ″.84.
Appearance of fracture, silky.

No. 5446.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 261.

Marks, 5 B_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0013	0.	
7,450	50,000	.0016	0.	
8,195	55,000	.0018	0.	Elastic limit.
8,344	56,000	.0086	.....	
8,493	57,000	.0089	.....	
8,642	58,000	.0092	.....	
8,791	59,000	.0100	.....	
8,940	60,000	.0107	.0082	
9,238	62,000	.0116	.....	
9,536	64,000	.0131	.....	
9,834	66,000	.0148	.....	
10,132	68,000	.0163	.....	
10,430	70,000	.0182	.0152	
10,728	72,000	.0197	.....	
11,026	74,000	.0212	.....	
11,324	76,000	.0234	.....	
11,622	78,000	.0259	.....	
11,920	80,000	.0281	.0244	
13,112	88,000	.04	.....	
13,708	92,000	.05	.....	
14,304	96,000	.07	.....	
14,900	100,000	.09	.....	
15,496	104,000	.12	.....	
15,690	105,300	.18	.....	Tensile strength.

Elongation of inch section, ″.31.
Exterior diameter at fracture, ″.83.
Appearance of fracture, silky.

No. 5447.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 261.

Marks, 5 B_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0014	.0001	
6,705	45,000	.0019	.....	
7,450	50,000	.0024	.0006	
7,599	51,000	.0026	.....	
7,748	52,000	.0027	.....	
7,897	53,000	.0028	.....	
8,046	54,000	.0030	.....	
8,195	55,000	.0032	.0012	
8,344	56,000	.0035	.....	
8,493	57,000	.0038	.....	
8,642	58,000	.0041	.....	
8,791	59,000	.0046	.....	
8,940	60,000	.0051	.0030	
9,238	62,000	.0061	.....	
9,536	64,000	.0075	.....	
9,834	66,000	.0090	.....	
10,132	68,000	.0105	.....	
10,430	70,000	.0119	.0089	
10,728	72,000	.0132	.....	
11,026	74,000	.0149	.....	
11,324	76,000	.0170	.....	
11,622	78,000	.0185	.....	
11,920	80,000	.0204	.0169	
13,112	88,000	.03	.....	
13,708	92,000	.04	.....	
14,304	96,000	.05	.....	
14,900	100,000	.06	.....	Crack in sight over the threaded section.
15,496	104,000	.07	.....	
16,092	108,000	.10	.....	
16,360	109,800	.16	.....	Tensile strength.

Elongation of inch section, ″.28.
Exterior diameter at fracture, ″.84.
Appearance of fracture, silky. Fracture occurred where sound metal existed.

No. 5442.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 276.

Marks, 5 B_5.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0013	0.	
7,450	50,000	.0017	0.	
8,046	54,000	.0018	.....	Elastic limit.
8,195	55,000	.0027	.....	
8,344	56,000	.0030	.....	
8,493	57,000	.0036	.....	
8,642	58,000	.0090	.....	
8,791	59,000	.0098	.....	
8,940	60,000	.0105	.....	
9,238	62,000	.0120	.....	
9,536	64,000	.0135	.....	
9,834	66,000	.0150	.....	
10,132	68,000	.0167	.....	
10,430	70,000	.0184	.0152	
10,728	72,000	.0200	.....	
11,026	74,000	.0220	.....	
11,324	76,000	.0240	.....	
11,622	78,000	.0264	.....	
11,920	80,000	.0286	.0250	
13,112	88,000	.04	.....	
13,559	92,000	.05	.....	
14,304	96,000	.06	.....	
14,900	100,000	.08	.....	
15,496	104,000	.11	.....	
15,720	105,500	.19	.....	Tensile strength.

Elongation of inch section, ″.29.
Exterior diameter at fracture, ″.84.
Appearance of fracture, silky.

No. 5443.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 276.

Marks, 5 B_5.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0012	0.	
6,705	45,000	.0017	.....	
7,450	50,000	.0026	.0009	
7,599	51,000	.0030	.....	
7,748	52,000	.0034	.....	
7,897	53,000	.0038	.....	
8,046	54,000	.0041	.....	
8,195	55,000	.0050	.0030	
8,344	56,000	.0055	.....	
8,493	57,000	.0059	.....	
8,642	58,000	.0065	.....	
8,791	59,000	.0073	.....	
8,940	60,000	.0079	.0055	
9,238	62,000	.0091	.....	
9,536	64,000	.0107	.....	
9,834	66,000	.0123	.....	
10,132	68,000	.0137	.....	
10,430	70,000	.0156	.0127	
10,728	72,000	.0175	.....	
11,026	74,000	.0192	.....	
11,324	76,000	.0214	.....	
11,622	78,000	.0234	.....	
11,920	80,000	.0262	.0225	
13,112	88,000	.04	.....	
13,708	92,000	.05	.....	
14,304	96,000	.06	.....	
14,900	100,000	.08	.....	
15,496	104,000	.14	.....	Tensile strength.

Elongation of inch section, ″.30.
Exterior diameter at fracture, ″.83.
Appearance of fracture, silky.

No. 5104.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 198.

Marks, 7 A_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0001	.....	
3,725	25,000	.0006	.....	
4,470	30,000	.0008	0.	
5,960	40,000	.0011	.....	
7,450	50,000	.0012	.....	
8,940	60,000	.0016	0.	
10,430	70,000	.0024	.0003	
11,920	80,000	.0054	.0025	
12,665	85,000	.0069	.....	
12,814	86,000	.0072	.....	
12,963	87,000	.0078	.....	
13,112	88,000	.0082	.....	
13,410	90,000	.0090	.0052	
13,559	91,000	.0098	.....	
13,708	92,000	.0100	.....	
14,006	94,000	.0107	.....	
14,155	95,000	.0113	.....	
14,304	96,000	.0116	.....	
14,453	97,000	.0120	.....	
14,602	98,000	.0125	.....	
14,751	99,000	.0133	.....	
14,900	100,000	.0136	.....	
15,049	101,000	.0142	.....	
15,198	102,000	.0146	.....	
15,347	103,000	.0153	.....	
15,496	104,000	.0157	.....	
15,645	105,000	.0163	.....	
15,794	106,000	.0167	.....	
15,943	107,000	.0174	.....	
16,092	108,000	.0182	.....	
16,241	109,000	.0186	.....	
16,390	110,000	.0193	.....	
16,539	111,000	.0198	.....	
16,688	112,000	.0205	.....	
16,837	113,000	.0210	.....	
16,986	114,000	.0216	.....	
17,135	115,000	.0224	.....	
17,284	116,000	.0233	.....	
17,433	117,000	.0238	.....	
17,582	118,000	.0246	.....	
17,731	119,000	.0254	.....	
17,880	120,000	.0260	.0206	
18,178	122,000	.0285	.....	
18,476	124,000	.03	.....	
18,774	126,000	.03	.....	
19,072	128,000	.04	.....	
19,668	132,000	.04	.....	
20,264	136,000	.05	.....	
20,860	140,000	.06	.....	
21,456	144,000	.07	.....	
22,150	148,660	.12	.....	Tensile strength.

Elongation of inch section, ″.12.
Exterior diameter at fracture, ″.94.
Appearance of fracture, granular.

Marks, 1 B_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In guaged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0004	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0015	0.	
6,109	41,000	.0015	.....	Elastic limit.
6,258	42,000	.0019	.....	
6,407	43,000	.0021	.....	
6,556	44,000	.0024	.....	
6,705	45,000	.0036	.....	
6,854	46,000	.0062	.....	
7,003	47,000	.0087	.....	
7,152	48,000	.0101	.....	
7,301	49,000	.0118	.....	
7,450	50,000	.0130	.0109	
7,599	51,000	.0149	.....	
7,748	52,000	.0157	.....	
7,897	53,000	.0186	.....	
8,046	54,000	.0203	.....	
8,195	55,000	.0233	.....	
8,344	56,000	.0254	.....	
8,493	57,000	.0287	.....	
8,642	58,000	.0318	.0289	Cracks in sight.
8,820	59,190	.....	.....	Tensile strength.

Elongation of inch section, ″.12.
Exterior diameter at fracture, ″.96.
Appearance of fracture, silky. Opened numerous cracks in cylindrical surface. These cracks formed during the endurance test of the shaft, and penetrated the metal to a depth of ″.03 +.

Annealed Annular Specimen from End of Endurance Shaft No. 251.

Marks, 1 B_3.

Diameters, { exterior, 1″. interior, ″.900

Sectional area, .149 square inch.

Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0014	0.	
6,407	43,000	.0015	.....	Elastic limit. Load fell.
5,513	37,000	.0054	.....	
5,662	38,000	.0085	.....	
5,811	39,000	.0222	.....	
5,960	40,000	.0242	.0225	
6,556	44,000	.04	.....	
7,152	48,000	.05	.....	
7,748	52,000	.07	.....	
8,344	56,000	.10	.....	
8,940	60,000	.17	.....	
9,030	60,600	.23	.....	Tensile strength.

Elongation of inch section, ″.47

Exterior diameter at fracture, ″.76

Appearance of fracture, silky.

Annealed Annular Specimen from Middle of Endurance Shaft No. 251.

Marks, 1 B_3.
Diameters, { exterior, 1″. / interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0011	0.	
5,215	35,000	.0013	.....	
5,960	40,000	.0015	.0001	
6,109	41,000	.0016	.....	Elastic limit. Load fell.
5,364	36,000	.0050	.....	
5,513	37,000	.0075	.....	
5,662	38,000	.0120	.....	
5,811	39,000	.0220	.....	
5 960	40,000	.0237	.0221	
6,556	44,000	.03	.....	
7,152	48,000	.05	.....	
7,748	52,000	.07	.....	
8,344	56,000	.10	.....	
8,940	60,000	.16	.....	
9,040	60,670	.23	.....	Tensile strength.

Elongation of inch section, ″.46.
Exterior diameter at fracture, ″.77.
Appearance of fracture, silky.

ANNEALED ANNULAR SPECIMEN FROM END O
No. 272.

Marks, 1 B_6.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0005	.....	
4,470	30,000	.0008	0.	
5,960	40,000	.0012	0.	
6,705	45,000	.0013+	.....	
7,301	49,000	.0016	.....	Elastic limit. Load
6,258	42,000	.0098	.....	
6,407	43,000	.0113	.....	
6,556	44,000	.0143	.....	
6,705	45,000	.0210	.....	
6,854	46,000	.0295	.....	
7,003	47,000	.0310	.....	
7,152	48,000	.0330	.....	
7,450	50,000	.04	.....	
7,748	52,000	.05	.....	
8,046	54,000	.06	.....	
8,344	56,000	.06+	.....	
8,642	58,000	.07	.....	
8,940	60,000	.08	.....	
9,238	62,000	.10	.....	
9,536	64,000	.13	.....	
9,834	66,000	.17	.....	
9,970	66,910	.23	.....	Tensile strength.

Elongation of inch section, ″.45.
Exterior diameter at fracture, ″.76.
Appearance of fracture, silky.

No. 5145.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 239.

Marks, 7 A_5.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0008	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0013	0.	
7,450	50,000	.0016	.....	
8,940	60,000	.0020	0.	
9,685	65,000	.0023	0.	
9,834	66,000	.0024	.....	
9,983	67,000	.0025	.....	
10,132	68,000	.0025	.....	
10,281	69,000	.0026	.....	
10,430	70,000	.0029	.0005	
10,579	71,000	.0032	.....	
10,728	72,000	.0035	.....	
10,877	73,000	.0037	.....	
11,026	74,000	.0039	.....	
11,175	75,000	.0043	.0015	
11,324	76,000	.0047	.....	
11,473	77,000	.0049	.....	
11,622	78,000	.0051	.....	
11,771	79,000	.0054	.....	
11,920	80,000	.0058	.0027	
12,218	82,000	.0066	.....	
12,516	84,000	.0072	.....	
12,814	86,000	.0080	.....	
13,112	88,000	.0088	.....	
13,410	90,000	.0097	.0058	
13,708	92,000	.0106	.....	
14,006	94,000	.0115	.....	
14,304	96,000	.0125	.....	
14,602	98,000	.0132	.....	
14,900	100,000	.0142	.0098	
16,092	108,000	.02—	.....	
17,284	116,000	.02+	.....	
18,476	124,000	.03	.....	
19,668	132,000	.04	.....	
20,860	140,000	.05	.....	
22,052	148,000	.09	.....	Tensile strength.

Elongation of inch section, ″.10.
Exterior diameter at fracture, ″.95.
Appearance of fracture, silky.

No. 5135.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 269.

Marks, 7 B_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0012	0.	
7,450	50,000	.0016	0.	
8,195	55,000	.0018	.....	
8,940	60,000	.0020	0.	
9,685	65,000	.0022	0.	
9,834	66,000	.0022	.....	
9,983	67,000	.0023	.....	
10,132	68,000	.0025	.....	
10,281	69,000	.0027	.....	
10,430	70,000	.0028	.0004	
10,579	71,000	.0031	.....	
10,728	72,000	.0032	.....	
10,877	73,000	.0034	.....	
11,026	74,000	.0035	.....	
11,175	75,000	.0039	.0010	
11,324	76,000	.0041	.....	
11,473	77,000	.0044	.....	
11,622	78,000	.0046	.....	
11,771	79,000	.0048	.....	
11,920	80,000	.0050	.0021	
12,218	82,000	.0057	.....	
12,516	84,000	.0062	.....	
12,814	86,000	.0069	.....	
13,112	88,000	.0076	.....	
13,410	90,000	.0085	.0048	
13,708	92,000	.0098	.....	
14,006	94,000	.0099	.....	
14,304	96,000	.0108	.....	
14,602	98,000	.0118	.....	
14,900	100,000	.0128	.0084	
16,092	108,000	.02	.....	
17,284	116,000	.03	.....	
18,476	124,000	.03	.....	
19,668	132,000	.04	.....	
20,860	140,000	.05	.....	
22,052	148,000	.07	.....	
22,340	149,930	.....	.....	Tensile strength.

Elongation of inch section, ″.08.
Exterior diameter at fracture, ″.96.
Appearance of fracture, granular.

No. 5136.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 269.

Marks, 7 B_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	6,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0012	0.	
7,450	50,000	.0016	.....	
8,195	55,000	.0018	.....	
8,940	60,000	.0020	0.	
9,685	65,000	.0023	.0001	
10,430	70,000	.0026	.0003	
10,579	71,000	.0028	.....	
10,728	72,000	.0029	.....	
10,877	73,000	.0030	.....	
11,026	74,000	.0030	.....	
11,175	75,000	.0031	.0005	
11,324	76,000	.0033	.....	
11,473	77,000	.0034	.....	
11,622	78,000	.0035	.....	
11,771	79,000	.0036	.....	
11,920	80,000	.0038	.0010	
12,218	82,000	.0041	.....	
12,516	84,000	.0045	.....	
12,814	86,000	.0050	.....	
13,112	88,000	.0055	.....	
13,410	90,000	.0060	.0029	
13,708	92,000	.0067	.....	
14,006	94,000	.0072	.....	
14,304	96,000	.0079	.....	
14,602	98,000	.0087	.....	
14,900	100,000	.0094	.0056	
16,092	108,000	.02—	.....	
17,284	116,000	.02	.....	
18,476	124,000	.03—	.....	
19,668	132,000	.03	.....	
20,860	140,000	.04	.....	
22,052	148,000	.05	.....	
22,610	151,740	.....	.....	Tensile strength.

Elongation of inch section, ″.05.
Exterior diameter at fracture, ″.98.
Appearance of fracture, granular.

No. 5146.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 248.

Marks, 7 B_3.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0011	0.	
7,450	50,000	.0015	.....	
8,940	60,000	.0019	0.	
9,685	65,000	.0023	.....	
10,430	70,000	.0025	.0002	
10,579	71,000	.0026	.....	
10,728	72,000	.0027	.....	
10,877	73,000	.0028	.....	
11,026	74,000	.0030	.....	
11,175	75,000	.0032	.0007	
11,324	76,000	.0035	.....	
11,473	77,000	.0037	.....	
11,622	78,000	.0039	.....	
11,771	79,000	.0042	.....	
11,920	80,000	.0044	.0016	
12,218	82,000	.0050	.....	
12,516	84,000	.0055	.....	
12,814	86,000	.0060	.....	
13,112	88,000	.0067	.....	
13,410	90,000	.0075	.0041	
13,708	92,000	.0084	.....	
14,006	94,000	.0090	.....	
14,304	96,000	.0098	.....	
14,602	98,000	.0105	.....	
14,900	100,000	.0114	.0074	
16,092	108,000	.02—	.....	
17,284	116,000	.02	.....	
18,476	124,000	.03—	.....	
19,668	132,000	.03	.....	
20,860	140,000	.04	.....	
22,052	148,000	.05	.....	
23,244	156,000	.08	.....	
23,570	158,190	.....	.....	Tensile strength.

Elongation of inch section, ″.10.
Exterior diameter at fracture, ″.96.
Appearance of fracture, granular.

No. 5147.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 248.

Marks, 7 B_3.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0012	0.	
7,450	50,000	.0016	0.	
8,195	55,000	.0018	.....	
8,940	60,000	.0020	0.	
9,685	65,000	.0023	.....	
10,430	70,000	.0027	.0003	
10,579	71,000	.0029	.....	
10,728	72,000	.0030	.....	
10,877	73,000	.0032	.....	
11,026	74,000	.0034	.....	
11,175	75,000	.0036	.0010	
11,324	76,000	.0039	.....	
11,473	77,000	.0042	.....	
11,622	78,000	.0043	.....	
11,771	79,000	.0047	.....	
11,920	80,000	.0049	.0019	
12,218	82,000	.0056	.....	
12,516	84,000	.0060	.....	
12,814	86,000	.0067	.....	
13,112	88,000	.0075	.....	
13,410	90,000	.0092	.0046	
13,708	92,000	.0096	.....	
14,006	94,000	.0099	.....	
14,304	96,000	.0108	.....	
14,602	98,000	.0118	.....	
14,900	100,000	.0126	.0082	
16,092	108,000	.02—	.....	
17,284	116,000	.02	.....	
18,476	124,000	.03—	.....	
19,668	132,000	.03	.....	
20,100	134,900	.....	.....	Tensile strength.

Elongation of inch section, ″.03.
Exterior diameter at fracture, ″.98.
Appearance of fracture, granular.

No. 5137.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 262.

Marks, 7 B_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0013	0.	
7,450	50,000	.0017	0.	
8,940	60,000	.0021	0.	
9,685	65,000	.0026	.0003	
9,834	66,000	.0027	.....	
9,983	67,000	.0029	.....	
10,132	68,000	.0030	.....	
10,281	69,000	.0032	.....	
10,430	70,000	.0034	.0008	
10,579	71,000	.0037	.....	
10,728	72,000	.0039	.....	
10,877	73,000	.0041	.....	
11,026	74,000	.0043	.....	
11,175	75,000	.0046	.0018	
11,324	76,000	.0050	.....	
11,473	77,000	.0053	.....	
11,622	78,000	.0055	.....	
11,771	79,000	.0057	.....	
11,920	80,000	.0060	.0029	
14,900	100,000	.02—	.....	
16,092	108,000	.02	.....	
17,284	116,000	.03—	.....	
18,476	124,000	.03	.....	
19,668	132,000	.04	.....	
20,860	140,000	.05	.....	
22,052	148,000	.07	.....	
22,190	148,930	.....	.....	Tensile strength.

Elongation of inch section, ″.08.
Exterior diameter at fracture, ″.98.
Appearance of fracture, granular.

Marks, 2 B_6.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0010	.....	
5,215	35,000	.0014	.0001	
5,364	36,000	.0015	.....	
5,513	37,000	.0016	.....	Elastic limit.
5,662	38,000	.0021	.....	
5,811	39,000	.0024	.....	
5,960	40,000	.0026	.0010	
6,109	41,000	.0031	.....	
6,258	42,000	.0035	.....	
6,407	43,000	.0039	.....	
6,556	44,000	.0049	.....	
6,705	45,000	.0070	.0052	
6,854	46,000	.0078	.....	
7,003	47,000	.0095	.....	
7,152	48,000	.0110	.....	
7,301	49,000	.0120	.....	
7,450	50,000	.0140	.0120	Crack in sight.
7,599	51,000	.0163	.....	
7,748	52,000	.0174	.....	
7,897	53,000	.0194	.....	
8,046	54,000	.0210	.....	
8,195	55,000	.0239	.0216	
8,940	60,000	.04	.....	
9,536	64,000	.05	.....	
10,132	68,000	.08	.....	
10,728	72,000	.16	.....	Tensile strength.

Elongation of inch section, ″.22.
Exterior diameter at fracture, ″.86.
Appearance of fracture, silky. Opened minute cracks in the cylindrical surface. Fracture began at the crack first observed and tore apart in detail.

Annular Specimen from End of Endurance Shaft No. 211.

Marks, 3 A_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	0.	
5,960	40,000	.0013	.....	
6,705	45,000	.0015	0.	
7,152	48,000	.0017	.....	
7,301	49,000	.0017	.....	Elastic limit.
7,450	50,000	.0021	.0004	
7,599	51,000	.0133	.....	
7,748	52,000	.0140	.....	
7,897	53,000	.0150	.....	
8,046	54,000	.0157	.....	
8,195	55,000	.0168	.0147	
8,344	56,000	.02	.....	
8,940	60,000	.03	.....	
9,536	64,000	.04—	.....	
10,132	68,000	.04	.....	
10,728	72,000	.05	.....	
11,324	76,000	.06	.....	
11,920	80,000	.08	.....	
12,516	84,000	.13	.....	
12,720	85,370	.19	.....	Tensile strength.

Elongation of inch section, ″.35.
Exterior diameter at fracture, ″.81.
Appearance of fracture, fine silky.

No. 5143.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 257.

Marks, 7 B_5.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0013	0.	
7,450	50,000	.0017	0.	
8,940	60,000	.0021	.0002	
9,685	65,000	.0024	.0003	
10,430	70,000	.0028	.0005	
10,579	71,000	.0030	.....	
10,728	72,000	.0032	.....	
10,877	73,000	.0034	.....	
11,026	74,000	.0035	.....	
11,175	75,000	.0037	.0010	
11,324	76,000	.0040	.....	
11,473	77,000	.0043	.....	
11,622	78,000	.0045	.....	
11,771	79,000	.0047	.....	
11,920	80,000	.0049	.0020	
12,218	82,000	.0054	.....	
12,516	84,000	.0060	.....	
12,814	86,000	.0067	.....	
13,112	88,000	.0074	.....	
13,410	90,000	.0082	.0046	
13,708	92,000	.0089	.....	
14,006	94,000	.0097	.....	
14,304	96,000	.0104	.....	
14,602	98,000	.0114	.....	
14,900	100,000	.0122	.0079	
16,092	108,000	.02	.....	
17,284	116,000	.02+	.....	
18,476	124,000	.03	.....	
19,668	132,000	.04	.....	
20,190	135,500	.....	.....	Tensile strength.

Elongation of inch section, ″.04.
Exterior diameter at fracture, ″.98.
Appearance of fracture, granular.

No. 5106.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT NO. 200.

Marks, 9 A_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0008	.....	
5,960	40,000	.0012	.....	
7,450	50,000	.0015	.....	
8,940	60,000	.0017	.0001	
10,430	70,000	.0039	.0017	
10,579	71,000	.0044	.....	
10,728	72,000	.0046	.....	
10,877	73,000	.0048	.....	
11,026	74,000	.0051	.....	
11,175	75,000	.0054	.....	
11,324	76,000	.0057	.....	
11,473	77,000	.0062	.....	
11,622	78,000	.0066	.....	
11,771	79,000	.0069	.....	
11,920	80,000	.0074	.....	
12,218	82,000	.0083	.....	
12,516	84,000	.0091	.....	
12,814	86,000	.0098	.....	
13,112	88,000	.0109	.....	
13,410	90,000	.0121	.0079	
13,708	92,000	.0127	.....	
14,006	94,000	.0136	.....	
14,304	96,000	.0147	.....	
14,602	98,000	.0159	.....	
14,900	100,000	.0171	.0125	
15,198	102,000	.0187	.....	
15,496	104,000	.0198	.....	
15,794	106,000	.0211	.....	
16,092	108,000	.0225	.....	
16,390	110,000	.0239	.....	
16,688	112,000	.0256	.....	
16,986	114,000	.0274	.....	
17,284	116,000	.0295	.....	
17,582	118,000	.0310	.....	
17,880	120,000	.0331	.....	
18,178	122,000	.0355	.....	
18,476	124,000	.0384	.....	
18,774	126,000	.0413	.....	
19,072	128,000	.0455	.....	
19,370	130,000	.0491	.....	
19,668	132,000	.06	.....	
20,264	136,000	.07	.....	
20,660	138,660	.12	.....	Tensile strength.

Elongation of inch section, ″.12.
Exterior diameter at fracture, ″.95.
Appearance of fracture, granular.

No. 5115.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 22.

Marks, 3 A_3.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0004	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	.....	
5,215	35,000	.0013	.0001	
5,960	40,000	.0017	.0003	
6,109	41,000	.0019	.....	
6,258	42,000	.0020	.....	
6,407	43,000	.0021	.....	
6,556	44,000	.0022	.....	
6,705	45,000	.0023	.0007	
6,854	46,000	.0025	.....	
7,003	47,000	.0027	.....	
7,152	48,000	.0028	.....	
7,301	49,000	.0029	.....	
7,450	50,000	.0030	.0011	
7,599	51,000	.0033	.....	
7,748	52,000	.0035	.....	
7,897	53,000	.0038	.....	
8,046	54,000	.0040	.....	
8,195	55,000	.0043	.0023	
8,344	56,000	.0047	.....	
8,493	57,000	.0050	.....	
8,642	58,000	.0053	.....	
8,791	59,000	.0059	.....	
8,940	60,000	.0064	.0041	Circumferential crack in sight.
9,536	64,000	.01	.....	
10,132	68,000	.02	.....	
10,728	72,000	.03	.....	
11,140	74,760	.04	.....	Tensile strength.

Elongation of inch section, ″.11.
Exterior diameter at fracture, ″.96.
Appearance of fracture, silky. Circumferential cracks developed. One dull spot extended through thickness of wall of specimen.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT NO. 216.

Marks, 3 A_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0014	0.	
6,705	45,000	.0016	.....	
7,450	50,000	.0017	.....	
7,599	51,000	.0018	.....	
7,748	52,000	.0019	.....	
7,897	53,000	.0020	.....	Elastic limit.
		.0147	.....	
8,046	54,000	.0155	.....	
8,195	55,000	.0166	.0144	
8,344	56,000	.02	.....	
8,940	60,000	.02+	.....	
9,536	64,000	.03	.....	
10,132	68,000	.04	.....	
10,728	72,000	.05	.....	
11,324	76,000	.06	.....	
11,920	80,000	.07	.....	
12,516	84,000	.10	.....	
12,980	87,110	.19	.....	Tensile strength.

Elongation of inch section, ″.35.
Exterior diameter at fracture, ″.81.
Appearance of fracture, fine silky.

No. 5113.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT NO. 216.

Marks, 3 A_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0004	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0011	.....	
5,662	38,000	.....	.....	Elastic limit (approximate).
5,960	40,000	.0018	.0003	
6,109	41,000	.0020	.....	
6,258	42,000	.0022	.....	
6,407	43,000	.0025	.....	
6,556	44,000	.0027	.....	
6,705	45,000	.0031	.0013	
6,854	46,000	.0034	.....	
7,003	47,000	.0037	.....	
7,152	48,000	.0041	.....	
7,301	49,000	.0048	.....	
7,450	50,000	.0052	.0032	
7,599	51,000	.0060	.....	
7,748	52,000	.0068	.....	
7,897	53,000	.0075	.....	
8,046	54,000	.0085	.....	
8,195	55,000	.0104	.....	
8,344	56,000	.0111	.....	
8,642	58,000	.0145	.....	
8,720	58,520	.....	.....	Tensile strength.

Elongation of inch section, ″.06.
Exterior diameter at fracture, ″.97.
Appearance of fracture, silky; numerous surface cracks developed.

Annular Specimen from End of Endurance Shaft No. 228.

Marks, 3 A_5.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0008	.....	
5,960	40,000	.0011	0.	
6,705	45,000	.0014	.....	
7,450	50,000	.0016	0.	
7,599	51,000	.0017	.....	Elastic limit.
		.0029	.....	
7,748	52,000	.0098	.....	
7,897	53,000	.0130	.....	
8,045	54,000	.0144	.....	
8,195	55,000	.0154	.0132	
8,344	56,000	.02	.....	
8,940	60,000	.02+	.....	
9,536	64,000	.03	.....	
10,132	68,000	.03+	.....	
10,728	72,000	.04	.....	
11,324	76,000	.05	.....	
11,920	80,000	.07—	.....	
12,516	84,000	.08	.....	
13,112	88,000	.13	.....	
13,260	88,990	.20	.....	Tensile strength.

Elongation of inch section, ″.36.
Exterior diameter at fracture, ″.80.
Appearance of fracture, fine silky.

No. 5411.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 235.

Marks, 9 A_6.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0013	.....	
7,450	50,000	.0018	.0001	
8,195	55,000	.0021	.....	
8,940	60,000	.0025	.0003	
9,089	61,000	.0026	.....	
9,238	62,000	.0027	.....	
9,387	63,000	.0028	.....	
9,536	64,000	.0029	.....	
9,685	65,000	.0032	.....	
9,834	66,000	.0035	.....	
9,983	67,000	.0037	.....	
10,132	68,000	.0039	.....	
10,281	69,000	.0041	.....	
10,430	70,000	.0044	.0017	
10,728	72,000	.0052	.....	
11,026	74,000	.0059	.....	
11,324	76,000	.0065	.....	
11,622	78,000	.0072	.....	
11,920	80,000	.0080	.0046	
12,218	82,000	.0089	.....	
12,516	84,000	.0094	.....	
12,814	86,000	.0104	.....	
13,112	88,000	.0113	.....	
13,410	90,000	.0123	.0081	
13,708	92,000	.0134	.....	
14,006	94,000	.0142	.....	
14,304	96,000	.0154	.....	
14,602	98,000	.0162	.....	
14,900	100,000	.0176	.0128	
16,092	108,000	.03—	.....	
17,284	116,000	.04—	.....	
18,476	124,000	.05	.....	
19,668	132,000	.06	.....	
20,450	137,250	.....	.....	Tensile strength.

Elongation of inch section, ″.07.
Exterior diameter at fracture, ″.97.
Appearance of fracture, granular.

No. 5414.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 249.

Marks, 9 B_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0012	.....	
7,450	50,000	.0015	0.	
8,195	55,000	.0018	.....	
8,940	60,000	.0020	0.	
9,685	65,000	.0023	.0001	
9,834	66,000	.0023	.....	
9,983	67,000	.0025	.....	
10,132	68,000	.0027	.....	
10,281	69,000	.0032	.....	
10,430	70,000	.0037	.0011	
10,728	72,000	.0044	.....	
11,026	74,000	.0050	.....	
11,324	76,000	.0055	.....	
11,622	78,000	.0061	.....	
11,920	80,000	.0069	.0038	
12,218	82,000	.0077	.....	
12,516	84,000	.0082	.....	
12,814	86,000	.0089	.....	
13,112	88,000	.0097	.....	
13,410	90,000	.0106	.0067	
13,708	92,000	.0116	.....	
14,006	94,000	.0123	.....	
14,304	96,000	.0131	.....	
14,602	98,000	.0140	.....	
14,900	100,000	.0150	.0105	
16,092	108,000	.02+	.....	
17,284	116,000	.03	.....	
18,476	124,000	.03+	.....	
19,668	132,000	.04	.....	
20,860	140,000	.05	.....	
22,052	148,000	.08	.....	
22,230	149,190	.....	.....	Tensile strength.

Elongation of inch section, ″.09.
Exterior diameter at fracture, ″.95.
Appearance of fracture, granular.

No. 5457.

ANNEALED ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT NO. 232.

Marks, 3 A_6.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0005	.....	
4,470	30,000	.0008	.....	
5,960	40,000	.0011	0.	
6,705	45,000	.0013	.....	
7,450	50,000	.0015	0.	
8,195	55,000	.0017	0.	Elastic limit.
8,344	56,000	.0020	.....	
8,493	57,000	.0025	.....	
8,642	58,000	.0086	.....	
8,791	59,000	.0187	.....	
8,940	60,000	.0197	.....	
10,132	68,000	.03	.....	
10,728	72,000	.04	.....	
11,324	76,000	.05	.....	
11,920	80,000	.06	.....	
12,516	84,000	.08	.....	
13,112	88,000	.10	.....	
13,540	90,870	.20	.....	Tensile strength.

Elongation of inch section, ″.36.
Exterior diameter at fracture, ″.81.
Appearance of fracture, silky.

Annular Specimen from End of Endurance Shaft No. 241.

Marks, 3 B_1.
Diameters, { exterior, 1″.
interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0013	.....	
7,450	50,000	.0017	0.	
7,599	51,000	.0017	.....	
7,748	52,000	.0018	.....	
7,897	53,000	.0018	.....	Elastic limit.
8,046	54,000	.0020	.....	
		.0136	.....	
8,195	55,000	.0148	.0128	
8,344	56,000	.02—	.....	
8,940	60,000	.02	.....	
9,536	64,000	.03	.....	
10,132	68,000	.03+	.....	
10,728	72,000	.04	.....	
11,324	76,000	.05	.....	
11,920	80,000	.06	.....	
12,516	84,000	.08	.....	
13,112	88,000	.11	.....	
13,460	90,330	.17	.....	Tensile strength.

Elongation of inch section, ″.36.
Exterior diameter at fracture, ″.81.
Appearance of fracture, fine silky.

No. 5119.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 21.

Marks, 3 B_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0008	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	0.	
5,960	40,000	.0012	0.	
6,705	45,000	.0015	.....	
6,854	46,000	.0015	.....	
7,003	47,000	.0016	.....	
7,152	48,000	.0017	.....	
7,301	49,000	.0019	.....	
7,450	50,000	.0021	.0004	
7,599	51,000	.0023	.....	
7,748	52,000	.0025	.....	
7,897	53,000	.0027	.....	
8,046	54,000	.0030	.....	
8,195	55,000	.0043	.0023	
8,344	56,000	.0054	.....	
8,493	57,000	.0070	.....	
8,642	58,000	.0081	.....	
8,791	59,000	.0092	.....	
8,940	60,000	.0103	.0080	
9,536	64,000	.02—	.....	
10,132	68,000	.02	.....	
10,728	72,000	.03	.....	
11,324	76,000	.03+	.....	
11,920	80,000	.04	.....	
12,516	84,000	.06	.....	
13,112	88,000	.08	.....	
13,708	92,000	.16	.....	Tensile strength.

Elongation of inch section, ″.32.
Exterior diameter at fracture, ″.82.
Appearance of fracture, silky.

Annealed Annular Specimen from End of Endurance Shaft No. 246.

Marks, 3 B_2.
Diameter, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0014	0.	
6,705	45,000	.0016	.....	
7,450	50,000	.0018	0.	
8,195	55,000	.0020	.....	
8,791	59,000	.0022	.....	Elastic limit. Load fell.
8,344	56,000	.0035	.....	
8,493	57,000	.0069	.....	
8,642	58,000	.0101	.....	
8,791	59,000	.0145	.....	
8,940	60,000	.0200	.0175	
9,536	64,000	.03	.....	
10,132	68,000	.03+	.....	
10,728	72,000	.04	.....	
11,324	76,000	.05	.....	
11,920	80,000	.06	.....	
12,516	84,000	.07	.....	
13,112	88,000	.10	.....	
13,708	92,000	.15	.....	
13,820	92,750	.24	.....	Tensile strength.

Elongation of inch section, ″.35.
Exterior diameter at fracture, ″.81.
Appearance of fracture, silky.

No. 5409.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 263.

Marks, 9 B_5.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0012	.....	
7,450	50,000	.0014	.0001	
8,940	60,000	.0019	.0002	
9,089	61,000	.0021	.....	
9,238	62,000	.0022	.....	
9,387	63,000	.0023	.....	
9,536	64,000	.0024	.....	
9,685	65,000	.0025	.0004	
9,834	66,000	.0026	.....	
9,983	67,000	.0028	.....	
10,132	68,000	.0029	.....	
10,281	69,000	.0029	.....	
10,430	70,000	.0030	.0007	
10,728	72,000	.0033	.....	
11,026	74,000	.0036	.....	
11,324	76,000	.0039	.....	
11,622	78,000	.0043	.....	
11,920	80,000	.0048	.0021	
12,218	82,000	.0056	.....	
12,516	84,000	.0060	.....	
12,814	86,000	.0065	.....	
13,112	88,000	.0070	.....	
13,410	90,000	.0078	.0045	
13,708	92,000	.0087	.....	
14,006	94,000	.0092	.....	
14,304	96,000	.0100	.....	
14,602	98,000	.0108	.....	
14,900	100,000	.0116	.0075	
16,092	108,000	.02—	.....	
17,284	116,000	.02	.....	
18,476	124,000	.03—	.....	
19,668	132,000	.03	.....	
20,860	140,000	.04	.....	
22,052	148,000	.05	.....	
23,244	156,000	.07	.....	
23,590	158,320	.....	.....	Tensile strength.

Elongation of inch sections, ″.09.
Exterior diameter at fracture, ″.96.
Appearance of fracture, fine granular.

No. 5108.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 202.

Marks, 11 A_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0013	.....	
7,450	50,000	.0017	.....	
8,940	60,000	.0020	0.	
9,089	61,000	.0020	.....	
9,238	62,000	.0020	.....	
9,387	63,000	.0020	.....	
9,536	64,000	.0021	.....	
9,685	65,000	.0021	.....	
9,834	66,000	.0021	.....	
9,983	67,000	.0023	.....	
10,132	68,000	.0049	.....	
10,281	69,000	.0067	.....	
10,430	70,000	.0069	.0040	
10,579	71,000	.0073	.....	
10,728	72,000	.0076	.....	
10,877	73,000	.0078	.....	
11,026	74,000	.0080	.....	
11,175	75,000	.0085	.....	
11,324	76,000	.0089	.....	
11,473	77,000	.0094	.....	
11,622	78,000	.0097	.....	
11,771	79,000	.0099	.....	
11,920	80,000	.0103	.0068	
12,218	82,000	.0113	.....	
12,516	84,000	.0120	.....	
12,814	86,000	.0129	.....	
13,112	88,000	.0138	.....	
13,410	90,000	.0149	.0105	
13,708	92,000	.0161	.....	
14,006	94,000	.0169	.....	
14,304	96,000	.0179	.....	
14,602	98,000	.0190	.....	
14,900	100,000	.0207	.0148	
15,198	102,000	.0218	.....	
15,496	104,000	.0229	.....	
15,794	106,000	.0241	.....	
16,092	108,000	.0253	.....	
16,390	110,000	.0268	.....	
16,688	112,000	.0286	.....	
16,986	114,000	.0300	.....	
17,284	116,000	.0321	.....	
17,582	118,000	.0340	.....	
17,880	120,000	.0363	.....	
18,178	122,000	.0391	.....	
18,476	124,000	.0417	.....	
18,774	126,000	.0452	.....	
19,072	128,000	.0487	.....	
19,370	130,000	.0555	.....	
19,668	132,000	.06	.....	
19,966	134,000	.07	.....	
20,164	135,330	.09	.....	Tensile strength.

Elongation of inch section, ″.09.
Exterior diameter at fracture, ″.95.
Appearance of fracture, granular.

No. 5109.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 202.

Marks, 11 A_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0014	.....	
7,450	50,000	.0017	.....	
8,940	60,000	.0022	.0001	
9,685	65,000	.0025	.....	
10,430	70,000	.0027	.0002	
11,175	75,000	.0031	.....	
11,920	80,000	.0035	.0005	
12,665	85,000	.0041	.....	
13,410	90,000	.0047	.0012	
14,155	95,000	.0058	.0021	
14,304	96,000	.0062	.....	
14,453	97,000	.0066	.....	
14,602	98,000	.0069	.....	
14,751	99,000	.0072	.....	
14,900	100,000	.0075	.0032	
16,390	110,000	.01	.....	
17,880	120,000	.02	.....	
19,370	130,000	.02+	.....	
20,860	140,000	.03	.....	
22,350	150,000	.05	.....	
22,980	154,230	.....	.....	Tensile strength.

Elongation of inch section, ″.08.
Exterior diameter at fracture, ″.96.
Appearance of fracture, fine granular.

No. 5422.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 237.

Marks, 11 A_5.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0013	.....	
7,450	50,000	.0017	0.	
8,195	55,000	.0019	.....	
8,940	60,000	.0021	.0001	
9,685	65,000	.0023	.....	
10,430	70,000	.0025	.0001	Elastic limit.
10,579	71,000	.0082	.....	
10,728	72,000	.0086	.....	
10,877	73,000	.0088	.....	
11,026	74,000	.0090	.....	
11 175	75,000	.0094	.0060	
11,324	76,000	.0101	.....	
11,473	77,000	.0106	.....	
11,622	78,000	.0108	.....	
11,771	79,000	.0110	.....	
11,920	80,000	.0113	.0076	
12,218	82,000	.0124	.....	
12,516	84,000	.0131	.....	
12,814	86,000	.0138	.....	
13,112	88,000	.0146	.....	
13,410	90,000	.0155	.0111	
13,708	92,000	.0166	.....	
14,006	94,000	.0173	.....	
14,304	96,000	.0184	.....	
14,602	98,000	.0195	.....	
14,900	100,000	.0204	.0153	
16,092	108,000	.03	.....	
17,284	116,000	.03+	.....	
18,476	124,000	.04	.....	
19,668	132,000	.06	.....	
20,860	140,000	.10	.....	Tensile strength.

Elongation of inch section, ″.11.
Exterior diameter at fracture, ″.94.
Appearance of fracture, granular.

No. 5441.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 37.

Marks, 3 B_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003		
2,980	20,000	.0006		
4,470	30,000	.0010		
5,960	40,000	.0013	0.	
6,705	45,000	.0015		
7,450	50,000	.0018	.0001	
7,897	53,000	.0019		
8,046	54,000	.0020		Elastic limit.
8,195	55,000	.0044	.0025	
8,344	56,000	.0094		
8,493	57,000	.0115		
8,642	58,000	.0125		
8,791	59,000	.0135		
8,940	60,000	.0145	.0121	
9,238	62,000	.0166		
9,536	64,000	.0191		
9,834	66,000	.0214		
10,132	68,000	.0250		
10,430	70,000	.0275	.0245	
11,324	76,000	.04		
11,920	80,000	.05		
12,516	84,000	.07		
13,112	88,000	.09		
13,510	90,670	.17		Tensile strength.

Elongation of inch section, ″.36.
Exterior diameter at fracture, ″.81.
Appearance of fracture, silky.

No. 5120.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 207.

Marks, 5 A_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0013	0.	
7,450	50,000	.0017	0.	
7,599	51,000	.0018	.....	
7,748	52,000	.0018	.....	Elastic limit.
7,897	53,000	.0085	.....	
8,046	54,000	.0088	.....	
8,195	55,000	.0095	.0071	
8,344	56,000	.0100	.....	
8,493	57,000	.0104	.....	
8,642	58,000	.0111	.....	
8,791	59,000	.0115	.....	
8,940	60,000	.0121	.0094	
9,536	64,000	.02	.....	
10,132	68,000	.02+	.....	
10,728	72,000	.03	.....	
11,324	76,000	.03+	.....	
11,920	80,000	.04	.....	
12,516	84,000	.04+	.....	
13,112	88,000	.05	.....	
13,708	92,000	.06	.....	
14,304	96,000	.08	.....	Tensile strength.
14 900	100,000	.14	.....	Tensile strength.
		.16	.....	

Elongation of inch section, ″.29.
Exterior diameter at fracture, ″.84.
Appearance of fracture, silky.

No. 5425.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 250.

Marks, 11 B_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0012	.....	
7,450	50,000	.0018	.0002	
8,195	55,000	.0023	.0004	
8,940	60,000	.0028	.0007	
9,685	65,000	.0038	.0014	
10,430	70,000	.0052	.0027	
10,579	71,000	.0056	.....	
10,728	72,000	.0058	.....	
10,877	73,000	.0061	.....	
11,026	74,000	.0063	.....	
11,175	75,000	.0067	.0038	
11,324	76,000	.0072	.....	
11,473	77,000	.0074	.....	
11,622	78,000	.0076	.....	
11,771	79,000	.0079	.....	
11,920	80,000	.0082	.0050	
12,218	82,000	.0090	.....	
12,516	84,000	.0095	.....	
12,814	86,000	.0103	.....	
13,112	88,000	.0111	.....	
13,410	90,000	.0119	.0079	
13,708	92,000	.0129	.....	
14,006	94,000	.0134	.....	
14,304	96,000	.0141	.....	
14,602	98,000	.0149	.....	
14,900	100,000	.0158	.0113	
16,092	108,000	.02+	.....	
17,284	116,000	.03—	.....	
18,476	124,000	.03	.....	
19,668	132,000	.04	.....	
20,860	140,000	.05	.....	
22,052	148,000	.07	.....	
22,580	151,540	.....	.....	Tensile strength.

Elongation of inch section, ″.08.
Exterior diameter at fracture, ″.96.
Appearance of fracture, granular.

No. 5420.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 256.

Marks, 11 B_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0013	.....	
7,450	50,000	.0017	0.	
8,195	55,000	.0019	.....	
8,940	60,000	.0020	0.	
9,685	65,000	.0022	.....	
10,430	70,000	.0024	0.	
10,579	71,000	.0025	.....	Elastic limit.
10,728	72,000	.0067	.....	
10,877	73,000	.0070	.....	
11,026	74,000	.0074	.....	
11,175	75,000	.0076	.0045	
11,324	76,000	.0080	.....	
11,473	77,000	.0084	.....	
11,622	78,000	.0086	.....	
11,771	79,000	.0089	.....	
11,920	80,000	.0092	.0058	
12,218	82,000	.0104	.....	
12,516	84,000	.0109	.....	
12,814	86,000	.0118	.....	
13,112	88,000	.0126	.....	
13,410	90,000	.0133	.0091	
13,708	92,000	.0144	.....	
14,006	94,000	.0151	.....	
14,304	96,000	.0159	.....	
14,602	98,000	.0167	.....	
14,900	100,000	.0179	.0130	
16,092	108,000	.02+	.....	
17,284	116,000	.03	.....	
18,476	124,000	.04	.....	
19,668	132,000	.04+	.....	
20,860	140,000	.06	.....	
21,680	145,500	.....	.....	Tensile strength.

Elongation of inch section, ″.08.
Exterior diameter at fracture, ″.96.
Appearance of fracture, granular.

No. 5421.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 256.

Marks, 11 B_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks,
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0012	.....	
7,450	50,000	.0018	.0002	
8,195	55,000	.0023	.....	
8,940	60,000	.0030	.0009	
9,685	65,000	.0042	.....	
10,430	70,000	.0054	.0028	
10,579	71,000	.0056	.....	
10,728	72,000	.0059	.....	
10,877	73,000	.0061	.....	
11,026	74,000	.0066	.....	
11,175	75,000	.0069	.0039	
11,324	76,000	.0073	.....	
11,473	77,000	.0075	.....	
11,622	78,000	.0077	.....	
11,771	79,000	.0080	.....	
11,920	80,000	.0083	.0051	
12,218	82,000	.0092	.....	
12,516	84,000	.0098	.....	
12,814	86,000	.0105	.....	
13,112	88,000	.0113	.....	
13,410	90,000	.0122	.0081	
13,708	92,000	.0131	.....	
14,006	94,000	.0138	.....	
14,304	96,000	.0146	.....	
14,602	98,000	.0154	.....	
14,900	100,000	.0162	.0117	
16,092	108,000	.02	.....	
17,284	116,000	.02+	.....	
18,476	124,000	.03	.....	
19,668	132,000	.04	.....	
20,860	140,000	.05	.....	
21,980	147,520	.....	.....	Tensile strength.

Elongation of inch section, ″.06.
Exterior diameter at fracture, ″.96.
Appearance of fracture, granular.

No. 5416.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 271.

Marks, 11 B_3.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0012	.....	
7,450	50,000	.0016	0.	
8,195	55,000	.0018	.....	
8,940	60,000	.0020	0.	
9,685	65,000	.0022	.....	
10,430	70,000	.0024	0.	
10,579	71,000	.0026	.....	
10,728	72,000	.0027	.....	Elastic limit
10,877	73,000	.0044	.....	
11,026	74,000	.0075	.....	
11,175	75,000	.0078	.0045	
11,324	76,000	.0083	.....	
11,473	77,000	.0086	.....	
11,622	78,000	.0088	.....	
11,771	79,000	.0091	.....	
11,920	80,000	.0094	.0059	
12,218	82,000	.0104	.....	
12,516	84,000	.0110	.....	
12,814	86,000	.0119	.....	
13,112	88,000	.0127	.....	
13,410	90,000	.0135	.0091	
13,708	92,000	.0146	.....	
14,006	94,000	.0153	.....	
14,304	96,000	.0161	.....	
14,602	98,000	.0171	.....	
14,900	100,000	.0181	.0130	
16,092	108,000	.02+	.....	
17,284	116,000	.03	.....	
18,476	124,000	.04	.....	
19,668	132,000	.05	.....	
20,860	140,000	.06	.....	
21,820	146,440	.....	.....	Tensile strength.

Elongation of inch section, ″.10.
Exterior diameter at fracture, ″.96.
Appearance of fracture, granular.

No. 5417.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 271.

Marks, 11 B_3.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Intial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0013	0.	
7,450	50,000	.0018	.0001	
8,195	55,000	.0022	.....	
8,940	60,000	.0027	.0005	
9,685	65,000	.0037	.0012	
10,430	70,000	.0048	.0022	
10,579	71,000	.0050	.....	
10,728	72,000	.0053	.....	
10,877	73,000	.0056	.....	
11,026	74,000	.0059	.....	
11,175	75,000	.0062	.0033	
11,324	76,000	.0067	.....	
11,473	77,000	.0070	.....	
11,622	78,000	.0072	.....	
11,771	79,000	.0075	.....	
11,920	80,000	.0079	.0045	
12,218	82,000	.0088	.....	
12,516	84,000	.0094	.....	
12,814	86,000	.0101	.....	
13,112	88,000	.0108	.....	
13,410	90,000	.0116	.0075	
13,708	92,000	.0127	.....	
14,006	94,000	.0133	.....	
14,304	96,000	.0142	.....	
14,602	98,000	.0151	.....	
14,900	100,000	.0161	.0113	
16,092	108,000	.02	.....	
17,284	116,000	.02+	.....	
18,476	124,000	.03	.....	
19,668	132,000	.04	.....	
20,860	140,000	.06	.....	
21,530	144,500	.....	.....	Tensile strength.

Elongation of inch section, ″.08.
Exterior diameter at fracture, ″.96.
Appearance of fracture, granular.

No. 5418.

ANNULAR SPECIMEN FROM END OF ENDURANCE SHAFT No. 264.

Marks, 11 B_6.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0005	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0012	0.	
7,450	50,000	.0016	.....	
8,195	55,000	.0018	.....	
8,940	60,000	.0020	0.	
9,685	65,000	.0022	.....	
10,430	70,000	.0025	0.	
10,579	71,000	.0044	.....	
10,728	72,000	.0067	.....	
10,877	73,000	.0070	.....	
11,026	74,000	.0073	.....	
11,175	75,000	.0076	.0044	
11,324	76,000	.0081	.....	
11,473	77,000	.0084	.....	
11,622	78,000	.0086	.....	
11,771	79,000	.0090	.....	
11,920	80,000	.0092	.0057	
12,218	82,000	.0103	.....	
12,516	84,000	.0109	.....	
12,814	86,000	.0116	.....	
13,112	88,000	.0125	.....	
13,410	90,000	.0133	.0089	
13,708	92,000	.0144	.....	
14,006	94,000	.0151	.....	
14,304	96,000	.0158	.....	
14,602	98,000	.0169	.....	
14,900	100,000	.0180	.0129	
16,092	108,000	.02	.....	
17,284	116,000	.03	.....	
18,476	124,000	.03+	.....	
19,668	132,000	.04	.....	
20,860	140,000	.06	.....	
21,620	145,100	.....	.....	Tensile strength.

Elongation of inch section, ″.09.
Exterior diameter at fracture, ″.96.
Appearance of fracture, granular.

No. 5419.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 264.

Marks, 11 B_8.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0010	.....	
5,960	40,000	.0013	.....	
7,450	50,000	.0017	0.	
8,195	55,000	.0022	.0002	
8,940	60,000	.0029	.0007	
9,685	65,000	.0041	.....	
10,430	70,000	.0054	.0027	
10,579	71,000	.0058	.....	
10,728	72,000	.0061	.....	
10,877	73,000	.0064	.....	
11,026	74,000	.0066	.....	
11,175	75,000	.0070	.0040	
11,324	76,000	.0076	.....	
11,473	77,000	.0080	.....	
11,622	78,000	.0082	.....	
11,771	79,000	.0083	.....	
11,920	80,000	.0088	.0054	
12,218	82,000	.0096	.....	
12,516	84,000	.0103	.....	
12,814	86,000	.0111	.....	
13,112	88,000	.0119	.....	
13,410	90,000	.0128	.0085	
13,708	92,000	.0139	.....	
14,006	94,000	.0145	.....	
14,304	96,000	.0154	.....	
14,602	98,000	.0162	.....	
14,900	100,000	.0173	.0125	
16,092	108,000	.02+	.....	
17,284	116,000	.03	.....	
18,476	124,000	.03+	.....	
19,668	132,000	.04	.....	
20,860	140,000	.06	.....	
21,560	144,700	.....	.....	Tensile strength.

Elongation of inch section, ″.10
Exterior diameter at fracture, ″.95.
Appearance of fracture, granular.

TABULATION OF ANNULAR TENSION SPECIMENS FROM BARS RUPTURED BY ENDURANCE TESTS OF ROTATING SHAFTS.

Tension test number.	Endurance test number.	Material.	Carbon.	Location in shaft.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Gauged length.	Elongation of inch section.	Appearance of fracture.
			Per cent.		*Sq. in.*	*Pounds.*	*Pounds.*	*Inch.*	*Per cent.*	
5428	226	Gautier steel	0.161	End	.149	42,000	60,130	1	46	Silky.
5429	226	do	0.161	Middle	.149	45,000	68,320	1	35	Silky. Opened numerous small cracks in cylindrical surface.
5452	225	do	0.161	End	.149	42,000	59,530	1	48	Silky.
5453	225	do	0.161	Middle	.149	41,000	58,990	1	47	Do.
5426	218	do	0.161	End	.149	44,000	61,680	1	46	Do.
5427	218	do	0.161	Middle	.149		37,520			40 per cent silky; 60 per cent dull smooth.
5430	244	do	0.161	End	.149	40,000	60,620	1	44	Silky.
5431	244	do	0.161	Middle	.149	41,000	59,190	1	12	Do.
5450	251	do	0.161	End	.149	43,000	60,600	1	47	Do
5451	251	do	0.161	Middle	.149	41,000	60,670	1	46	Do.
5448	272	do	0.161	End	.149	49,000	66,910	1	45	Do.
5449	272	do	0.161	Middle	.149	48,000	66,340	1	46	Do.
5432	245	do	0.172	End	.149	45,000	70,070	1	44	Do.
5433	245	do	0.172	Middle	.149	39,000	74,290	1	35	Do.
5434	252	do	0.172	End	.149	39,000	72,620	1	40	Do.
5435	252	do	0.172	Middle	.149		75,100	1	37	Do.
5436	259	do	0.172	End	.149	45,000	70,340	1	42	Do.
5437	259	do	0.172	Middle	.149	37,000	72,000	1	22	Do.
5110	211	do	0.341	End	.149	49,000	85,370	1	35	Do.
5111	211	do	0.341	Middle	.149	48,000	88,320	1	31	Fine silky.
5114	223	do	0.341	End	.149	50,000	87,050	1	37	Do.
5115	223	do	0.341	Middle	.149		74,780	1	11	Silky, dull spot.
5112	216	do	0.341	End	.149	53,000	87,110	1	35	Fine silky.
5113	216	do	0.341	Middle	.149	38,000	58,520	1	6	Silky.
5116	228	do	0.341	End	.149	51,000	88,990	1	36	Do.
5117	228	do	0.341	Middle	.149		35,640	1		40 per cent silky; 60 per cent dull smooth.
5456	232	do	0.341	End	.149	64,000	93,760	1	39	Silky.
5457	232	do	0.341	Middle	.149	55,000	90,870	1	36	Do.

Tabulation of annular tension specimens from bars ruptured by endurance tests of rotating shafts—Continued.

Tension test number.	Endurance test number.	Material.	Carbon.	Location in shaft.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Gauged length.	Elongation of inch section.	Appearance of fracture.
			Per cent.		*Sq. in.*	*Pounds.*	*Pounds.*	*Inch.*	*Per cent.*	
5118	241	Gautier steel	0.341	End	.149	53,000	90,330	1	36	Fine silky.
5119	241	do	0.341	Middle	.149		92,000	1	32	Silky.
5454	246	do	0.341	End	.149	59,000	92,750	1	35	Do.
5455	246	do	0.341	Middle	.149	56,000	92,080	1	38	Do.
5438	253	do	0.341	End	.149	54,000	91,010	1	37	Do.
5439	253	do	0.341	Middle	.149		95,770	1	32	Do.
5440	275	do	0.341	End	.149	50,000	87,050	1	31	Do.
5441	275	do	0.341	Middle	.149	54,000	90,670	1	36	Do.
5120	207	do	0.552	End	.149	52,000	100,000	1	29	Do.
5121	207	do	0.552	Middle	.149		111,480	1	27	Do.
5102	208	do	0.552	End	.149	52,000	107,330	1	28	Do.
5103	208	do	0.552	Middle	.149		77,000	1		Granular, dull-colored spots.
5122	215	do	0.552	End	.149	52,000	102,480	1	27	Silky.
5123	215	do	0.552	Middle	.149		108,000	1	22	Do.
5124	222	do	0.552	End	.149		102,350	1	29	Do.
5125	222	do	0.552	Middle	.149		87,110	1	06	Silky and in part dull smooth.
5126	229	do	0.552	End	.149	55,000	103,760	1	28	Silky.
5127	229	do	0.552	Middle	.149		106,000	1	28	Do.
5460	233	do	0.552	End	.149	70,000	119,330	1	28	Do.
5461	233	do	0.552	Middle	.149	65,000	116,580	1	30	Do.
5458	247	do	0.552	End	.149	67,000	112,210	1	29	Do.
5459	247	do	0.552	Middle	.149	67,000	109,660	1	28	Do.
5131	240	do	0.552	End	.149	55,000	105,910	1	30	Do.
5132	240	do	0.552	Middle	.149		107,580	1	28	Do.
5444	254	do	0.552	End	.149	55,000	108,000	1	29	Do.
5445	254	do	0.552	Middle	.149		108,590	1	29	Do.
5446	261	do	0.552	End	.149	53,000	105,300	1	31	Do.
5447	261	do	0.552	Middle	.149		109,800	1	28	Do.

5442	276	.....do	0.552	End	.149	54,000	105,500	1	29	Do.
5443	276	.....do	0.552	Middle	.149	.....	104,000	1	80	Do.
5104	198	.....do	0.733	End	.149	.....	148,660	1	12	Granular.
5105	198	.....do	0.733	Middle	.149	.....	150,000	1	6	Do.
5133	199	.....do	0.733	End	.149	68,000	144,830	1	11	Do.
5134	199	.....do	0.733	Middle	.149	.....	154,700	1	12	Do.
5144	230	.....do	0.733	End	.149	.....	152,610	1	14	Do.
5145	239	.....do	0.733	Middle	.149	.....	148,000	1	10	Do.
5135	269	.....do	0.733	End	.149	.....	149,930	1	8	Do.
5136	269	.....do	0.733	Middle	.149	.....	151,740	1	5	Do.
5146	248	.....do	0.733	End	.149	.....	158,190	1	10	Do.
5147	248	.....do	0.733	Middle	.149	.....	134,900	1	3	Do.
5137	262	.....do	0.733	End	.149	.....	148,930	1	8	Do.
5138	262	.....do	0.733	Middle	.149	.....	144,830	1	7	Do.
5142	257	.....do	0.733	End	.149	67,000	144,360	1	8	Do.
5143	257	.....do	0.733	Middle	.149	.....	135,500	1	4	Do.
5106	200	.....do	0.824	End	.149	.....	138,660	1	12	Do.
5107	200	.....do	0.824	Middle	.149	.....	114,760	1	1	Granular, small dull spot.
5412	238	.....do	0.824	End	.149	.....	139,530	1	8	Granular.
5413	238	.....do	0.824	Middle	.149	.....	135,440	1	11	Do.
5410	235	.....do	0.824	End	.149	63,000	141,070	1	11	Do.
5411	235	.....do	0.824	Middle	.149	.....	137,250	1	7	Do.
5414	249	.....do	0.824	End	.149	.....	149,190	1	9	Do.
5415	249	.....do	0.824	Middle	.149	66,000	142,280	1	6	Do.
5148	270	.....do	0.824	End	.149	.....	152,620	1	9	Fine granular.
5149	270	.....do	0.824	Middle	.149	.....	158,250	1	9	Do.
5408	263	.....do	0.824	End	.149	.....	154,700	1	8	Do.
5409	263	.....do	0.824	Middle	.149	.....	158,320	1	9	Do.
5108	202	.....do	1.094	End	.149	.....	135,330	1	9	Granular.
5109	202	.....do	1.094	Middle	.149	.....	154,230	1	8	Fine granular.
5422	237	.....do	1.094	End	.149	70,000	140,000	1	11	Granular.
5423	237	.....do	1.094	Middle	.149	70,000	142,680	1	5	Do.
5424	250	.....do	1.094	End	.149	72,000	146,780	1	10	Do.
5425	250	.....do	1.094	Middle	.149	.....	151,540	1	8	Do.

Tabulation of annular tension specimens from bars ruptured by endurance tests of rotating shafts—Continued.

Tension test number.	Endurance test number.	Material.	Carbon.	Location in shaft.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Gauged length.	Elongation of inch section.	Appearance of fracture.
			Per cent.		*Sq. in.*	*Pounds.*	*Pounds.*	*Inch.*	*Per cent.*	
5420	256	Gautier steel	1.094	End	.149	71,000	145,500	1	8	Granular.
5421	256	do	1.094	Middle	.149		147,520	1	6	Do.
5416	271	do	1.094	End	.149	72,000	146,440	1	10	Do.
5417	271	do	1.094	Middle	.149		144,500	1	8	Do.
5418	264	do	1.094	End	.149		145,100	1	9	Do.
5419	264	do	1.094	Middle	.149		144,700	1	10	Do.

ANNULAR SPECIMENS WHICH HAVE NO DETAILS OF ELONGATIONS.

Tension test number.	Endurance test number.	Material.	No. of bar.	Fiber stress per square inch.	Temperature of endurance test.	Location in shaft.	Tensile strength.		Elongation of inch section.		Exterior diameter after rupture.	Fractures, etc.
							Total.	Per square inch.	At maximum load.	After rupture.		
				Pounds.	°*F.*		*Pounds.*	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
7876	268	Gautier steel	5 B_3	55,000	35	End.....	16,160	108,450	.16	.29	.86	Silky.
7877	268	.....do	5 B_3	55,000	35	Middle....	16,870	113,220	.15	.25	.88	Silky. Minute cracks in surface not penetrating deeply.
7878	234	.....do	7 A_5	45,000	35	End.....	22,300	149,660	.11	.13	.93	Granular.
7879	234	.....do	7 A_5	45,000	35	Middle....	21,530	144,490	.10	.13	.93	Do.
7880	221	.....do	7 A_4	50,000	85	End.....	21,690	145,570	.10	.12	.94	Do.
7881	221	.....do	7 A_4	50,000	85	Middle....	19,910	133,620	.....	.....	.98	Granular. A fine line scored on the surface appeared to locate place of fracture.
7882	214	.....do	7 A_3	52,460	100	End.....	23,060	154,760	.11	.12	.94	Granular.
7883	214	.....do	7 A_3	52,460	100	Middle....	23,020	154,490	.....	.08	.97	Do.
7884	255	.....do	9 B_2	45,000	35	End.....	23,180	155,570	.....	.07	.97	Do.
7885	255	.....do	9 B_2	45,000	35	Middle....	21,510	144,360	.....	.03	.98	Granular. Fractured outside the gauged length.
7886	220	.....do	9 A_4	50,000	85	End.....	19,880	133,420	.....	.09	.95	Granular.
7887	220	.....do	9 A_4	50,000	85	Middle....	20,680	138,790	.....	.06	.96	Do.
7888	213	.....do	9 A_3	52,460	100	End.....	21,790	146,240	.....	.10	.95	Do.
7889	213	.....do	9 A_3	52,460	100	Middle....	21,740	145,910	.....	.07	.97	Do.
7890	236	.....do	11 A_5	45,000	35	End.....	20,660	138,660	.....	.10	.95	Do.
7891	236	.....do	11 A_5	45,000	35	Middle....	21,340	143,220	.....	.06	.97	Do.
7892	219	.....do	11 A_4	50,000	85	End.	20,720	139,060	.....	.08	.96	Do.
7893	219	.....do	11 A_4	50,000	85	Middle....	11,800	79,190	.....	.01	1.00	Granular. Incipient fracture commenced during endurance test on one side of shaft.
7894	212	.....do	11 A_3	52,460	85	End.....	21,640	145,230	.....	.09	.96	Granular.
7895	212	.....do	11 A_3	52,460	85	Middle....	21,040	141,210	.....	.08	.96	Do.

CHEMICAL ANALYSES OF STEELS FROM SPRINGFIELD ARMORY.

Tension test number.	Description.	Marks.	Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.	Nickel.	
			Total.	Graphitic.	Combined.							
5234	For parts of rifle barrels....	No. 12	0.429	0.020	0.409	0.910	0.300	0.056	0.136	0.000	.....	For tension test see page 89.
	For rifle barrels	No. 1	0.510	0.008	0.502	1.185	0.078	0.085	0.012	0.050	.....	
	.....do	No. 2	0.910	0.010	0.900	0.376	0.261	0.020	0.024	0.041	.....	
	.....do	No. 3	1.050	0.013	1.037	0.185	0.123	0.015	0.011	0.065	.....	
	.....do	No. 4	0.138	0.006	0.132	0.888	0.005	0.096	0.043	.....	.....	
5285	.....do	M. G	0.504	0.013	0.491	0.142	0.075	0.010	0.046	.....	.....	Moss & Gamble's Manufacture, Sheffield, England. For tension test see page 94.
5264	.....do	No. 28	0.526	0.022	0.504	1.017	0.086	0.043	0.061	0.000	.....	For tension test see page 92.
5265	For receivers of rifles.....	N. S	0.186	0.018	0.168	1.128	0.035	0.004	0.039	0.000	0.000	For tension test see page 140.
5276	.....do	P. B. F	0.368	0.031	0.337	1.075	0.039	0.020	0.095	0.010	0.000	For tension test see page 142.
	.....do	P. B. F	0.304	0.029	0.275	0.843	0.047	0.104	0.070	.....	.....	
	.....do	No. 3	0.154	0.006	0.148	0.974	0.005	0.085	0.050	.....	.....	
	Bayonet steel.....	No. 2	1.059	0.011	1.048	0.356	0.169	0.010	0.015	0.000	.....	
	.....do	.....	1.185	0.049	1.136	0.270	0.230	0.015	0.026	0.000	.....	
	For bands	No. 1	0.173	0.008	0.165	0.991	0.004	0.090	0.083	.....	.....	

CHEMICAL ANALYSES.

Material.	Marks.	Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.	Aluminum.
		Total.	Graphitic.	Combined.						
Steel casting for 12" mortar carriage	12 C 197 C L_1 M	0.302	0.026	0.276	0.610	0.413	0.069	0.041	0.079	None.
Do	12 C 197 C L_2 M	0.301	0.023	0.278	0.539	0.376	0.054	0.021	0.077	None.
Do	12 C 204 C T_1 M	0.368	0.029	0.339	0.827	0.434	0.045	0.050	0.083	None.
Do	12 C 204 C L_3 M	0.243	0.027	0.216	0.475	0.342	0.045	0.027	0.078	None.
Steel casting	No. A	0.350	0.033	0.317	0.923	0.275	0.036	0.040	0.000	.....
Do	No. B	0.334	0.032	0.302	0.916	0.275	0.035	0.042	0.000	.....
12" jacket	5537 B_1 M T 9 O	0.568	0.014	0.554	0.697	0.144	0.033	0.024	.....	.....
Do	5537 B_1 B T 12 O	0.570	0.014	0.556	0.702	0.148	0.033	0.025	.....	.....
Do	5537 B_1 M T 11 M	0.562	0.014	0.548	0.683	0.144	0.033	0.024	.....	.....
Do	5537 B_1 B T 9 M	0.529	0.014	0.515	0.712	0.135	0.030	0.024	.....	.....
Annealed fragment of armor-piercing projectile	.....	0.358	0.021	0.337	0.258	0.185	0.017	0.046	.....	.....

SHOT LINES.

SHOT LINES.

TENSION TESTS OF LINEN SHOT LINES FOR THE UNITED STATES LIFE-SAVING SERVICE.

The No. 4 and No. 7 lines were stored in the testing room before testing the relative humidity for six days preceding, the tests being as follows: 62, 64, 61, 50, 28, 40. During the tests the humidity was 50 the first day and 38 the second day.

No. 4 LINES.

Diameter, ".14.
Lay, one turn in $\frac{9}{16}$" to $\frac{5}{8}$".
Three strands of four threads each.
Threads two-ply.
Length of samples between pins, 4 feet.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	Lbs. oz.		*Pounds.*	
7184	10 0	Outside.....	267	1 strand 8" from pin.
7185	10 4	.....do	332	3 strands at pin.
7186	10 6	Inside	316	1 strand 2" from pin.
7187	10 5	Outside.....	302	2 strands 21" from pin.
7188	10 6	.....do	304	2 strands 5" from pin.
7189	10 5	.....do	284	1 strand 18" from pin.
7190	10 4	.....do	284	1 strand 21" from pin.
7191	10 5	Inside	358	1 strand 3" from pin.
7192	10 3	Outside.....	310	2 strands 22" from pin.
7193	10 4	.....do	286	1 strand 23" from pin.
7194	10 6	.....do	298	1 strand 12" from pin.
7195	10 5	Inside	386	1 strand 17" from pin.
7196	10 5	Outside.....	299	2 strands 19" from pin.
7197	10 7	.....do	318	1 strand 17" from pin.
7198	10 6	.....do	348	2 strands 9" from pin.
7199	10 5	.....do	351	1 strand 11" from pin.
7200	10 6	Inside	344	1 strand 19" from pin.
7201	10 5	Outside.....	312	2 strands 2" from pin.
7202	10 5	Inside	382	2 strands 6" from pin.
7203	10 5	Outside.....	267	1 strand 7" from pin.
7204	10 5	.....do	274	1 strand 8" from pin.
7205	10 4	Inside	341	1 strand at middle.
7206	10 7	.....do	310	1 strand 10" from pin.
7207	10 5	Outside.....	340	1 strand at middle.
7208	10 5	.....do.....	314	2 strands 2" from pin.
7209	10 5	.....do	250	1 strand 0" from pin.
7210	10 7	.....do	288	1 strand 10" from pin.
7211	10 7	.....do	289	1 strand 13" from pin.
7212	10 7	Inside	301	2 strands at pin.
7213	10 6	.....do	307	1 strand 17" from pin.
7214	10 5	Outside.....	281	2 strands 12" from pin.
7215	10 6	Inside	326	1 strand 11" from pin.
7216	10 6	Outside.....	295	2 strands 14" from pin.
7217	10 6	.....do	281	2 strands 7" from pin.
7218	10 5	.....do	334	1 strand 2" from pin.
7219	10 5	Inside	391	1 strand 12" from pin.
7220	10 5	Outside.....	277	1 strand 18" from pin.
7221	10 6	.....do	288	1 strand 20" from pin.
7222	10 7	.....do	275	1 strand at middle.
7223	10 7	.....do	280	1 strand 22" from pin.
7224	10 7	Inside	320	1 strand 18" from pin.
7225	10 6	Outside.....	301	2 strands 6" from pin.
7226	10 4	.....do	285	2 strands at pin.
7227	10 5	.....do	288	Do.
7228	10 7	.....do	297	1 strand 17" from pin.
7229	10 5	.....do	291	1 strand 16" from pin.
7230	10 4	Inside	350	1 strand 4" from pin.
7231	10 7	Outside.....	262	1 strand 22" from pin.
7232	10 5	.....do	278	2 strands at pin.
7233	10 6	Inside	351	1 strand 7" from pin.

No. 7 LINES.

Diameter, ".21.
Lay, one turn in about ¾".
Three strands of eight threads each.
Threads two-ply.
Length of samples between pins, 4 feet.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	Lbs. oz.		*Pounds.*	
7234	19 2	Outside.....	664	2 strands 17" from pin.
7235	19 2	.....do	694	1 strand 13" from pin.
7236	19 4	Inside	582	1 strand 18" from pin.
7237	19 2	Outside.....	696	2 strands 8" from pin.
7238	19 2	Inside	646	1 strand at pin.
7239	19 2	Outside.....	702	2 strands 7" from pin.
7240	19 2	.....do	681	2 strands at pin.
7241	19 3	Inside	665	1 strand at pin.
7242	19 3	Outside.....	518	2 strands 2" from pin.
7243	19 3	.....do..	552	1 strand 12" from pin.
7244	19 3	Inside	667	2 strands 16" from pin.
7245	19 4	Outside.....	502	2 strands at pin.
7246	19 3	Inside	702	1 strand at pin.
7247	19 3	Outside.....	704	2 strands at pin.
7248	19 4	.....do	591	Do.
7249	19 6	.....do	554	1 strand at pin.
7250	19 6	.....do	533	1 strand 6" from pin.
7251	18 15	.....do	648	1 strand 15" from pin.
7252	19 3	.....do	539	1 strand near middle.
7253	18 15	Inside	683	1 strand at pin.
7254	18 15	Outside.....	573	Do.
7255	18 15	.....do	563	1 strand 5" from pin.
7256	18 15	.....do	527	1 strand at middle.
7257	19 0	.....do	649	2 strands at pin.
7258	19 4	Inside	654	1 strand at pin.
7259	19 3	Outside.....	603	2 strands at pin.
7260	18 4	.....do	555	1 strand at pin.
7261	19 4	Inside	598	1 strand at middle.
7262	19 0	Outside.....	608	1 strand 18" from pin.
7263	19 5	Inside	660	2 strands 12" from pin.
7264	19 2	Outside.....	654	1 strand at pin.
7265	19 0	.....do	498	Do.
7266	18 14	Inside	521	1 strand 16" from pin.
7267	19 0	Outside.....	597	2 strands at pin.
7268	19 0	.....do	610	1 strand 20" from pin.
7269	19 1	.....do	504	2 strands 3" from pin.
7270	18 14	Inside	644	2 strands at pin.
7271	19 4	Outside.....	596	1 strand 12" from pin.
7272	19 2	.....do	609	1 strand 6" from pin.
7273	19 0	.....do	537	1 strand at pin.
7274	19 1	.....do	602	1 strand 14" from pin.
7275	19 0	.....do	505	1 strand 20" from pin.
7276	19 0	.....do	539	1 strand at pin.
7277	18 15	.....do	560	Do.
7278	18 15	.....do	547	1 strand 4" from pin.
7279	19 0	.....do	586	1 strand at middle.
7280	19 2	.....do	577	1 strand at pin.
7281	19 0	.....do	593	1 strand at middle.
7282	19 3	.....do	428	1 strand 12" from pin.
7282a	19 3	.....do	667	1 strand 14" from pin.
7283	19 5	Inside	646	1 strand 12" from pin.

Supplementary tests of samples after being stored 6 days in a room having a mean relative humidity of 72.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	Lbs. oz.		*Pounds.*	
7237*a*	.....	Outside.....	748	3 strands at pin.
7239*a*	.....	.....do	758	1 strand 5″ from pin.
7242*a*	.....	.....do	544	2 strands 2″ from pin.
7245*a*	.....	.....do	568	1 strand 17″ from pin.
7246*a*	.....	.....do	560	1 strand at middle.
7247*a*	.....	.....do	756	2 strands at pin.
7250*a*	.....	.....do	592	1 strand at middle.
7252*a*	.....	.....do	588	1 strand at pin.
7256*a*	.....	.....do	566	1 strand 19″ from pin.
7265*a*	.....	.....do	682	1 strand 7″ from pin.
7266*a*	.....	.....do	694	1 strand 8″ from pin.
7269*a*	.....	.....do	605	1 strand at pin.
7273*a*	.....	.....do	681	2 strands at pin.
7275*a*	.....	.....do	607	1 strand at middle.
7282*b*	.....	.....do	561	1 strand 20″ from pin.

The average strength of these 15 supplementary tests is 634 pounds, whereas the average strength of the original tests was 510 pounds, thus showing a difference of 124 pounds, which is attributed to the difference in moisture in the samples at the time of testing.

No. 9 Shot Lines.

Diameter, ".29.
Lay, one turn in 1⅛" to 1 3/16".
Three strands of sixteen threads each.
Threads two-ply.
Length of samples between pins, 4 feet.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	Lbs. oz.		*Pounds.*	
7907	36 0	Inside	1,358	1 strand at pin.
7908	35 12	do	1,398	1 strand at middle.
7909	35 4	Outside	1,220	1 strand at pin.
7910	36 0	do	1,218	Do.
7911	36 0	do	1,322	Do.
7912	36 4	Inside	1,384	Do.
7913	36 4	Outside	1,286	1 strand 16" from pin.
7914	35 12	do	1,392	2 strands at pin.
7915	35 12	Inside	1,395	1 strand at pin.
7916	36 4	do	1,322	Do.
7917	36 0	Outside	1,426	1 strand 10" from pin.
7918	36 0	do	1,402	1 strand at pin.
7919	35 8	Inside	1,285	1 strand 12" from pin.
7920	35 8	Outside	1,040	1 strand at pin.
7920 *a*		do	1,220	1 strand 12" from pin.
7921	36 0	do	1,413	1 strand at pin.
7922	36 4	do	1,385	2 strands at pin.
7923	36 4	Inside	1,634	1 strand at middle.
7923 *a*		do	1,490	1 strand at pin.
7924	36 0	do	1,497	2 strands at pin.
7925	36 8	Outside	1,310	1 strand at pin.
7926	36 4	do	1,366	1 strand 12" from pin.
7927	36 4	Inside	1,595	1 strand at middle.
7928	35 12	Outside	1,280	1 strand at pin.
7929	35 0	Inside	1,345	1 strand at middle.
7930	36 0	Outside	1,195	1 strand at pin.
7931	36 0	do	1,251	1 strand 18" from pin.
7932	36 4	Inside	1,400	1 strand at pin.
7933	36 0	do	1,394	Do.
7934	36 4	Outside	1,458	1 strand 20" from pin.
7935	36 0	do	1,496	1 strand at middle.
7936	36 0	Inside	1,612	Do.
7937	36 0	Outside	1,402	1 strand at pin.
7938	36 0	Inside	1,520	Do.
7939	36 4	Outside	1,244	1 strand 9" from pin.
7940	36 0	Inside	1,493	1 strand at pin.
7941	36 4	Outside	1,248	1 strand at middle.
7942	36 0	do	1,550	2 strands at pin.
7943	36 8	do	1,395	1 strand 10" from pin.
7944	36 8	Inside	1,552	1 strand at pin.
7945	36 0	Outside	1,486	Do.
7946	35 8	Inside	1,378	Do.
7947	35 8	Outside	1,352	Do.
7948	35 8	Inside	1,608	Do.
7949	36 4	Outside	1,274	Do.
7950	36 4	Inside	1,594	Do.
7951	36 4	Outside	1,488	Do.
7952	36 4	do	1,375	1 strand 12" from pin.
7953	35 0	Inside	1,205	2 strands at pin.
7954	36 4	do	1,392	1 strand at pin.
7955	36 4	Outside	1,310	Do.
7956	35 8	Inside	1,402	1 strand at middle.

TENSION TESTS OF SINGLE THREADS TAKEN FROM NO. 9 SHOT LINES.

Coil No. 7920.			Coil No. 7923.		
Tensile strength.			Tensile strength.		
First strand.	Second strand.	Third strand.	First strand.	Second strand.	Third strand.
Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
29	36	23	36	40	36
36	38	22	42	37	33
34	34	37	32	35	41
33	28	25	43	40	34
28	41	32	37	37	47
35	34	33	32	41	47
31	33	28	28	33	40
32	41	38	26	37	42
33	37	35	27	34	40
29	33	36	43	38	34
28	29	36	35	35	23
27	42	41	40	41	34
40	26	35	44	42	33
32	28	26	30	37	37
31	32	28	36	36	31
36	30	46	39	39	37
514	542	541	579	602	589

Aggregate strength of threads: Coil No. 7920, 1,597 pounds; coil No. 7923, 1,770 pounds.

Tests made for private parties during the fiscal year ended June 30, 1895.

Date.	Material.	For whom tested.		
		Name.	City.	State.
1894.				
July...	Porous terra-cotta.	Boston Fire Proofing Co	Boston	Mass.
	Steel boiler plate..	Hartford Steam Boiler Inspection and Insurance Co.	Hartford	Conn.
	Granite	Thomas Lahey	Haverhill	Mass.
	Steel bars	Howe, Brown & Co., Limited	Boston	Mass.
	Rubber belting...	Revere Rubber Co	....do	Mass.
	Leather seams....	Union Special Sewing Machine Co	....do	Mass.
	Steel plates	Edwd. Kendall & Sons	Cambridgeport	Mass.
	Piston rod	B. M. Jones & Co	Boston	Mass.
	Rail joint	J. H. Williams	....do	Mass.
	Bricks	The Donnelly Brick Co	New Britain	Conn.
	Copper cylinders..	Leonard Smokeless Powder Co	New York	N. Y.
	Cast-iron pinions..	E. D. Leavitt	Cambridgeport	Mass.
Aug...	Pig iron	C. L. Pierson & Co	Boston	Mass.
	Steel plates	Edwd. Kendall & Sons	Cambridgeport	Mass.
	Angle bar	A. H. Howland	Boston	Mass.
	Cotton rope	Arthur A. Brigham	....do	Mass.
	Paving brick	Somerset & Johnsonburg Manufacturing Co.	....do	Mass.
	Steel block	Ferracute Machine Co	Bridgeton	N. J.
	Copper cylinders..	G. H. Sampson	New York	N. Y.
	Weighing machine	Chapman Derrick and Wrecking Co.	....do	N. Y.
	Steel plates	Metropolitan Sewerage Com	Boston	Mass.
	Rubber springs...	A. H. Emery	Stamford	Conn.
	Rail joint	J. H. Williams	Boston	Mass.
Sept...	Steel plates	The Corliss Steam Engine Co	Providence	R. I.
	Riveted joints	....do	....do	R. I.
	Bricks	Henry Hastings	Boston	Mass.
	Cotton rope	Arthur A. Brigham	....do	Mass.
	Aluminum bronze	Waldo Foundry	New York	N. Y.
	Steel plate	Edwd. Kendall & Sons	Cambridgeport	Mass.
	Stone	Klingberg & Clark	Kingston	N. Y.
	Red stone	The Portage Entry Quarries Co	Chicago	Ill.
Oct....	Nails in wood	D. Frank Lord	Boston	Mass.
	Aluminum bronze	Waldo Foundry	New York	N. Y.
	Chain	Thomson Electric Welding Co	Lynn	Mass.
	Wrought iron	Portland Rolling Mill Co	Portland	Me.
	Cast iron	E. D. Leavitt	Cambridgeport	Mass.
	Concrete	P. K. Yates	New York	N. Y.
	Brick	Gay Head Clay and Brick Co	Chelsea	Mass.
	Paving brick	Hamburg Brick Co	Hamburg	Pa.
	Angle bars	A. H. Howland	Boston	Mass.
Nov ...	Steel bars	Whittier Machine Co	....do	Mass.
	Sandstone	Edward C. Scriggs	Nashville	Tenn.
	Hollow building blocks.	The Akron Fire Brick Co	Akron	Ohio.
	Steel plates	City of Medford	Medford	Mass.
	Paving bricks	Somerset & Johnsonburg Manufacturing Co.	Boston	Mass.
	Paving brick	Minneapolis Hydraulic Pressed Brick Co.	Minneapolis	Minn.
	Steel plates	Hartford Steam Boiler Inspection and Insurance Co.	Hartford	Conn.
	Brass tubing	Benedict & Burnham Manufacturing Co.	Boston	Mass.
Dec....	Bronze	Pneumatic Torpedo and Construction Co.	New York	N. Y.
	Steel plates	City of Medford	Medford	Mass.
	Rubber belting...	Boston Woven Hose and Rubber Co.	Cambridgeport	Mass.
	Cotton duck	....do	....do	Mass.
	German-silver wire.	E. D. Leavitt	....do	Mass.
	Helical springs	....do	....do	Mass.
	Boiler-tube metal.	Hartford Steam Boiler Inspection and Insurance Co.	Hartford	Conn.
	Steel plates	Wm. Allen & Sons	Worcester	Mass.
	Sandstone	Northern Construction Co	Tacoma	Wash.
	Cast iron	Armington & Sims Engine Co	Providence	R. I.
	Copper tubes	Benedict & Burnham Manufacturing Co.	Boston	Mass.
1895.				
Jan....	Cotton duck	Harding, Whitman & Co	....do	Mass.
	Cast iron	Rhode Island Locomotive Works	Providence	R. I.
	Sandstone	Wm. J. Read, jr	Elkins	W. Va.

Tests made for private parties during the fiscal year ended June 30, 1895—Continued.

Date.	Material.	For whom tested.		
		Name.	City.	State.
1895.				
Jan....	Bricks and concrete.	Boston Transit Commission.....	Boston.....	Mass.
	Brick piers	.....do	.....do	Mass.
	Bicycle frames....	Premier Cycle Co.....	New York.....	N. Y.
	Tubing	.....do	.....do	N. Y.
	Lock-nut track bolts.	Walter L. Clark.....	.....do	N. Y.
	Manganese steel..	Taylor Iron and Steel Co.....	High Bridge.....	N. J.
	Sole sewing thread	Commonwealth Shoe and Leather Co.	Boston.....	Mass.
	Steel plates.....	Rhode Island Locomotive Works .	Providence	R. I.
	Sole sewing thread	Willimantic Linen Co	Boston.....	Mass.
Feb....	Low Moor iron....	Houghton & Richards	.....do	Mass.
	Trap rock	John S. Lane.....	Meriden	Conn.
	Slate	Brownville (Me.) Slate Co.....	Worcester.....	Mass.
	Steel bars.....	Taylor Iron and Steel Co	High Bridge.....	N. J.
Mar....	Cotton thread	Willimantic Linen Co.....	Boston.....	Mass.
	Loop-ended bars..	Job Abbott.....	New York.....	N. Y.
	Shot lines.....	M. F. Whiton & Co	Boston.....	Mass.
	Building blocks ..	E. Bigelow.....	Westview	Ohio.
	Pig iron	Richmond Iron Works.	Richmond Furnace.	Mass.
	Wrought-iron plates.	Hartford Steam Boiler Inspection and Insurance Co.	Hartford.....	Mass.
	Wrought-iron bars.	Geo. F. Blake, jr.....	Boston.....	Mass.
	Paving bricks	The Mill Hall Brick Works	Lock Haven	Pa.
	Wood.....	Otis Allen & Son	Lowell	Mass.
	Manganese steel..	Taylor Iron and Steel Co.....	High Bridge.....	N. J.
Apr ...	Screws in wood...	Simonds Rolling Machine Co	Fitchburg.....	Mass.
	Trap rock	Byxbee-De Peyster Trap Rock Co ..	Meriden	Conn.
	Shot lines.....	M. F. Whiton & Co	Boston.....	Mass.
	Rubber belting ...	Revere Rubber Co.....	.....do	Mass.
	Harness traces ...	Judson L. Thomson Manufacturing Co.	Waltham	Mass.
	Test gauge	Star Brass Manufacturing Co	Boston.....	Mass.
	Bricks.....	Rhode Island Granite Pressed Brick Co.	Woonsocket.....	R. I.
	Canvas belting ...	Sawyer Belting Co.....	East Cambridge..	Mass.
	Sandstone	Oregon Improvement Co.....	Seattle.....	Wash.
	Wrought iron.....	Geo. F. Blake, jr	Boston.....	Mass.
	Gas-pipe metal....	Hiram Walker.....	Detroit	Mich.
	Wrought iron.....	New York and New England R. R. Co.	Boston.....	Mass.
	Bricks.....	City of Boston.....	.....do	Mass.
May ...	Steel-wire ropes...	Geo. S. Morison	New York.....	N. Y.
	Steel plates.....	Schenectady Locomotive Works....	Schenectady.....	N. Y.
	Cast iron.....	Pittsburg Testing Laboratory.....	Pittsburg.....	Pa.
	Bronze.....	.....do.....	.....do	Pa.
	Rubber belting...	Revere Rubber Co.....	Boston.....	Mass.
	Granite.....	A. J. Salinas & Sons.....	Charleston.....	S. C.
	Cast iron.....	F. B. Foster & Co	South Boston.....	Mass.
	Steel bar.....	E. D. Leavitt.....	Cambridgeport ...	Mass.
	Coupling links and pins.	New York, New Haven and Hartford R. R. Co.	New Haven.....	Conn.
	Welded steel and iron.	Herring-Hall-Marvin Co.....	New York.....	N. Y.
June...	Sash chains.....	"Thomas Morton".....	.....do	N. Y.
	Aluminum.....	W. E. C. Eustis	Boston.....	Mass.
	Aluminum block.	.....do	.....do	Mass.
	Cotton rope.....	Arthur A. Brigham.....	.....do	Mass.
	Bronze.....	Pittsburg Testing Laboratory.....	Pittsburg.....	Pa.
	Cast iron.....	.....do	.....do	Pa.
	Iron plate	Hartford Steam Boiler Inspection and Insurance Co.	Hartford.....	Conn.
	Tackle blocks	Walter Coleman & Sons	Providence	R. I.
	Steel plate.....	Cunningham Iron Works.....	Boston.....	Mass.
	Aluminum alloy..	C. F. Whitney.....	Newtonville	Mass.
	Riveted joint.....	Babcock & Wilcox Co.....	New York.....	N. Y.
	Rubber belting ...	Revere Rubber Co.....	Boston.....	Mass.
	Red granite.....	John Daneker	Whitehaven	Pa.
	Purchase blocks..	Boston Tow Boat Co.....	Boston.....	Mass.
	Tube	Pneumatic Torpedo and Construction Co.	New York.....	N. Y.
	Sandstone	Charles A. Carlson.....	Seattle.....	Wash.
	Bricks.....	City of Woonsocket.....	Woonsocket.....	R. I.

INDEX.

Page.

Analyses, chemical:
- Bands for rifles 702
- Bayonet steel 702
- Cast iron 179
- Endurance shafts, steel 597, 598
- Jacket, 12-inch, steel 703
- Mortar carriage, 12-inch, steel castings 703
- Pig irons 181
- Projectile, armor-piercing 703
- Receivers of rifles 702
- Rifle barrel steel 702
- Steel castings 703
- Stones, natural 425

Blocks, building. (See Building material.)

Bolts, "vibration proof"—
- Tension and vibration tests 291

Bricks. (See Building material.)

Bronze 195
- Tobin 223
- Watertown Arsenal—
  - Cylinder lining 12-inch gun-lift carriage 202
  - Loading trays, 8-inch 197–201
  - Loading trays, 12-inch 204, 205
  - Specimen turned down from 1-inch bar 203
  - Tabulation 206

Building material, natural stones, bricks, and cement 317
- Remarks 319
- Blocks, hollow, compression tests—
  - Gladding, McBean & Co., San Francisco, Cal 527–531
  - Muscatine Terra Cotta Lumber Company, Muscatine, Iowa 451, 532–535
  - Powhatan Clay Manufacturing Company, Richmond, Va 518–526
- Bricks, absorption of water 435, 436
- Bricks, building, compression tests—
  - Bay State Brick Company, Boston, Mass 437
  - Blandford Brick and Tile Company, Russell, Mass 439
  - Brush & Schmidt, Buffalo, N. Y 443
  - Coaldale Brick and Tile Company, Coaldale, Ala 448
  - Clark Pressed Brick Company, Malvern, Ark 453
  - Gay Head Clay and Brick Company, Chelsea, Mass 438
  - Gladding, McBean & Co., San Francisco, Cal 457
  - Hamlet, Noah, Little Rock, Ark 454
  - Hunton, M. D., Fort Smith, Ark 454
  - Kansas City Hydraulic Press Brick Company, Kansas City, Mo 452
  - Kelley Brick and Tile Company, Minneapolis, Minn 456

Building material, etc.—Continued. Page.
Bricks, building, compression tests—Continued.
Monticello Brick Works, Monticello, Minn. 455
National Brick and Tile Company, Bradford, Pa. 444
New England Steam Brick Company, Providence, R. I. 440, 441
New Hampshire Molded Granite Company, Keene, N. H. 458
Powhatan Clay Manufacturing Company, Richmond, Va. 446
Sayre & Fisher Company, Sayreville, N. J. 444
Superior Brick Company, Rockford, Ill. 451
Washington Hydraulic Press Brick Company, Washington, D. C. 445
Bricks, fire, compression tests—
Blandford Brick and Tile Company, Russell, Mass. 439
Clark Pressed Brick Company, Malvern, Ark. 453
Eharker, John, Ashby, Ala. 449
Gay Head Clay and Brick Company, Chelsea, Mass. 438
Gladding, McBean & Co., San Francisco, Cal. 457
Pacific Clay Manufacturing Company, Los Angeles, Cal. 458
Bricks, paving, compression tests—
Blandford Brick and Tile Company, Russell, Mass. 437
Brush & Schmidt, Buffalo, N. Y. 444
Capital City Vitrified Brick and Paving Company, Topeka, Kans. 455
Clark Pressed Brick Company, Malvern, Ark. 453
Coaldale Brick and Tile Company, Coaldale, Ala. 448
Grant Brick Company, Franklin, Pa. 445
Hamlet, Noah, Little Rock, Ark. 454
Hunton, M. D., Fort Smith, Ark. 454
Humphrey, A., Minneapolis, Minn. 456
Jones, A. O., Brick and Terra Cotta Company, Zanesville, Ohio. 450
Monticello Brick Works, Monticello, Minn. 455
Muscatine Terra Cotta Lumber Company, Muscatine, Iowa. 451
New England Steam Brick Company, Providence, R. I. 441
Somerset & Johnsonburg Manufacturing Company, Boston, Mass. 437
Half bricks, fragments after transverse tests—
Bay State Brick Company, Boston, Mass. 437
Blandford Brick and Tile Company, Russell, Mass. 439
Brooke Terra Cotta Company, Lazearville, W. Va. 447
Capital City Vitrified Brick and Paving Company, Topeka, Kans. 455
Coaldale Brick and Tile Company, Coaldale, Ala. 448
Eharker, John, Ashby, Ala. 449
Gay Head Clay and Brick Company, Chelsea, Mass. 438
Grant Brick Company, Franklin, Pa. 445
Humphrey, A., Minneapolis, Minn. 457
Jones, A. O., Brick and Terra Cotta Company, Zanesville, Ohio. 450
Kansas City Hydraulic Press Brick Company, Kansas City, Mo. 452
Monticello Brick Works, Monticello, Minn. 456
New England Steam Brick Company, Providence, R. I. 442, 443
Pacific Clay Manufacturing Company, Los Angeles, Cal. 458
Powhatan Clay Manufacturing Company, Richmond, Va. 447
Bricks, compressive elastic properties—
Brooke Terra Cotta Company, Lazearville, W. Va. 476–478
Chicago Hydraulic Press Brick Company, Chicago, Ill. 479, 480
Clark Pressed Brick Company, Malvern, Ark. 486
Eastern Hydraulic Press Brick Company, Philadelphia, Pa. 470–472
Gladding, McBean & Co., San Francisco, Cal. 488–493
Hydraulic Press Brick Company, St. Louis, Mo. 483–485
Kansas City Hydraulic Press Brick Company, Kansas City, Mo. 481, 482

Building material, etc.—Continued. Page.
Bricks, compressive elastic properties—Continued.
Northern Hydraulic Press Brick Company, Minneapolis, Minn..... 487
Philadelphia and Boston Face Brick Company, Boston, Mass..... 463–469
Powhatan Clay Manufacturing Company, Richmond, Va 473–476
Bricks, shearing tests—
Eharker, John, Ashby, Ala 507
Gay Head Clay and Brick Company, Chelsea, Mass..... 505
Grant Brick Company, Franklin, Pa..... 506
New England Steam Brick Company, Providence, R. I..... 505, 506
Powhatan Clay Manufacturing Company, Richmond, Va..... 507
Bricks, transverse tests—
Bay State Brick Company, Boston, Mass 497
Blandford Brick and Tile Company, Russell, Mass..... 497
Brooke Terra Cotta Company, Lazearville, W. Va 500
Capital City Vitrified Brick and Paving Company, Topeka, Kans ... 501
Coaldale Brick and Tile Company, Coaldale, Ala 500
Eharker, John, Ashby, Ala 501
Gay Head Clay and Brick Company, Chelsea, Mass..... 497
Grant Brick Company, Franklin, Pa 499
Jones, A. O., Brick and Terra Cotta Company, Zanesville, Ohio..... 501
Kansas City Hydraulic Press Brick Company, Kansas City, Mo..... 501
Kelley Brick and Tile Company, Minneapolis, Minn..... 502
Monticello Brick Works, Monticello, Minn 502
New England Steam Brick Company, Providence, R. I 498, 499
New Hampshire Molded Granite Company, Keene, N. H..... 502
Pacific Clay Manufacturing Company, Los Angeles, Cal..... 502
Powhatan Clay Manufacturing Company, Richmond, Va..... 500
Sayre & Fisher Company, Sayreville, N. J 499
Bricks, general tabulation..... 508–517
Cement, Dyckerhoff's, Neat..... 389
Stone, artificial—
Granite, molded, New Hampshire Molded Granite Company, Keene, N. H..... 458
Stones, natural—
Coefficient of expansion, and effects of heat and cold in air and water..... 418–424
Chemical analyses..... 425
General description 325
Relative strength under different kinds of tests..... 319, 320
Relative strength before and after exposure to water baths 321
Swelling of, in water baths..... 322
Stones, natural, compression tests—
Granite—
Broad Rock, Chesterfield County, Va..... 329
Exeter, Tulare County, Cal..... 330
Korah Station, Va..... 330
Little Rock, Pulaski County, Ark..... 329
Millbridge, Me..... 329
Rockville, Minn 330
St. Paul, Minn 331
Jasper, St. Paul, Minn 331
Limestone—
Beaver, Carroll County, Ark..... 333
Bradford, Washington County, Ind 334
Bowling Green, Ky 334

Building material, etc.—Continued. Page.
Stones, natural, compression tests—Continued.
Limestone—Continued.
Isle La Motte, Vt. 332
Junction City, Kans. 333
Rockwood, Ala. 334
Wasioja, Dodge County, Minn. 333
Marble—
Mountain dark, Vt. 331
Richville white, St. Lawrence County, N. Y. 332
Rutland blue, Vt. 331
Rutland white, Vt. 331
St. Joe, Searcy County, Ark. 332
Sutherland Falls, Vt. 331
Sandstone—
Bandera, Redfield, Kans. 336
Cabin Creek, Johnson County, Ark. 336
Coquille River, Coos County, Oreg. 337
Cromwell, Conn. 335
Fort Smith, Ark. 336
Jasper, Ala. 335
Kettle River, Pine County, Minn. 335
Piedmont, Alameda County, Cal. 337
Pittsburg, Pierce County, Wash. 338
Tenino, Thurston County, Wash. 337
Stones, natural, compressive elastic properties—
Granite—
Brandford, Conn. 348, 349
Little Rock, Pulaski County, Ark. 341–343
Milford, Mass. 350, 351
Millbridge, Me. 344
Rockville, Minn. 345
St. Paul, Minn. 346
Troy, N. H. 347
Limestone—
Beaver, Carroll County, Ark. 368, 369
Bedford, Washington County, Ind. 371–373
Bowling Green, Ky. 370
Isle La Motte, Vt. 366
Mount Vernon, Ky. 367
Marble—
Cherokee, Ga. 365
Creole, Ga. 364
Marble Hill, Ga. 362, 363
Mountain dark, Vt. 357
Richville white, St. Lawrence County, N. Y. 361
Rutland blue, Vt. 355, 356
Rutland white, Vt. 352, 354
St. Joe, Searcy County, Ark. 359, 360
Sutherland Falls, Vt. 358
Sandstone—
Cabin Creek, Johnson County, Ark. 382
Chuckanut, Wash. 386
Cooper, Douglas County, Oreg. 384
Cromwell, Conn. 375

Building material, etc.—Continued. Page.
Stones, natural, compressive elastic properties—Continued.
Sandstone—Continued.
Fort Smith, Ark ... 383
Kibbe, East Longmeadow, Mass ... 378, 379
Maynard, East Longmeadow, Mass ... 380, 381
Olympia, Wash ... 385
Tenino, Thurston County, Wash ... 387
Worcester, East Longmeadow, Mass ... 376, 377
Slate, Monson, Me ... 374
Stones, natural, shearing tests—
Granite—
Broad Rock, Chesterfield County, Va ... 409
Exeter, Tulare County, Cal ... 410
Korah Station, Va ... 410
Little Rock, Pulaski County, Ark ... 409
Millbridge, Me ... 409
Rockville, Minn ... 410
St. Paul, Minn ... 411
Limestone—
Beaver, Carroll County, Ark ... 412
Bedford, Washington County, Ind ... 413
Bowling Green, Ky ... 413
Fort Riley, Kans ... 412
Isle La Motte, Vt ... 411
Rockwood, Ala ... 413
Wasioja, Dodge County, Minn ... 412
Marble—
Mountain dark, Vt ... 411
Rutland blue, Vt ... 411
Rutland white, Vt ... 411
Sutherland Falls, Vt ... 411
Sandstone—
Bandera, Redfield, Kans ... 415
Cabin Creek, Johnson County, Ark ... 415
Chuckanut, Wash ... 417
Coquille River, Coos County, Oreg ... 416
Cromwell, Conn ... 414
Fort Smith, Ark ... 415
Jasper, Ala ... 414
Kettle River, Pine County, Minn ... 414
Olympia, Oreg ... 416
Piedmont, Alameda County, Cal ... 416
Tenino, Thurston County, Wash ... 417
Stones, natural, transverse tests—
Granite—
Brandford, Conn ... 395
Broad Rock, Chesterfield County, Va ... 393
Exeter, Tulare County, Cal ... 394
Korah Station, Va ... 394
Little Rock, Pulaski County, Ark ... 393
Milford, Mass ... 395
Millbridge, Me ... 393
Rockville, Minn ... 394
St. Paul, Minn ... 395
Troy, N. H ... 395

Tabulation of annular tension specimens from bars ruptured by endurance tests of rotating shafts—Continued.

Tension test number.	Endurance test number.	Material.	Carbon.	Location in shaft.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Gauged length.	Elongation of inch section.	Appearance of fracture.
			Per cent.		*Sq. in.*	*Pounds.*	*Pounds.*	*Inch.*	*Per cent.*	
5420	256	Gautier steel	1.094	End	.149	71,000	145,500	1	8	Granular.
5421	256	do	1.094	Middle	.149		147,520	1	6	Do.
5416	271	do	1.094	End	.149	72,000	146,440	1	10	Do.
5417	271	do	1.094	Middle	.149		144,500	1	8	Do.
5418	264	do	1.094	End	.149		145,100	1	9	Do.
5419	264	do	1.094	Middle	.149		144,700	1	10	Do.

ANNULAR SPECIMENS WHICH HAVE NO DETAILS OF ELONGATIONS.

Tension test number.	Endurance test number.	Material.	No. of bar.	Fiber stress per square inch.	Temperature of endurance test.	Location in shaft.	Tensile strength.		Elongation of inch section.		Exterior diameter after rupture.	Fractures, etc.
							Total.	Per square inch.	At maximum load.	After rupture.		
				Pounds.	°*F.*		*Pounds.*	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	
7876	268	Gautier steel	5 B_6	55,000	35	End.....	16,160	108,450	.16	.29	.86	Silky.
7877	268	.....do	5 B_6	55,000	35	Middle....	16,870	113,220	.15	.25	.88	Silky. Minute cracks in surface not penetrating deeply.
7878	234	.....do	7 A_6	45,000	35	End.....	22,300	149,660	.11	.13	.93	Granular.
7879	234	.....do	7 A_6	45,000	35	Middle....	21,530	144,490	.10	.13	.93	Do.
7880	221	.....do	7 A_4	50,000	85	End.....	21,690	145,570	.10	.12	.94	Do.
7881	221	.....do	7 A_4	50,000	85	Middle....	19,910	133,620	.....	.....	.98	Granular. A fine line scored on the surface appeared to locate place of fracture.
7882	214	.....do	7 A_3	52,460	100	End.....	23,060	154,760	.11	.12	.94	Granular.
7883	214	.....do	7 A_3	52,460	100	Middle....	23,020	154,490	.....	.08	.97	Do.
7884	255	.....do	9 B_2	45,000	35	End.....	23,180	155,570	.....	.07	.97	Do.
7885	255	.....do	9 B_2	45,000	35	Middle....	21,510	144,360	.....	.03	.98	Granular. Fractured outside the gauged length.
7886	220	.....do	9 A_4	50,000	85	End.....	19,880	133,420	.....	.09	.95	Granular.
7887	220	.....do	9 A_4	50,000	85	Middle....	20,680	138,790	.....	.08	.96	Do.
7888	213	.....do	9 A_3	52,460	100	End.....	21,790	146,240	.....	.10	.95	Do.
7889	213	.....do	9 A_3	52,460	100	Middle....	21,740	145,910	.....	.07	.97	Do.
7890	236	.....do	11 A_6	45,000	35	End.....	20,660	138,660	.....	.10	.95	Do.
7891	236	.....do	11 A_6	45,000	35	Middle....	21,340	143,220	.....	.06	.97	Do.
7892	219	.....do	11 A_4	50,000	85	End.....	20,720	139,060	.....	.08	.96	Do.
7893	219	.....do	11 A_4	50,000	85	Middle....	11,800	79,190	.....	.01	1.00	Granular. Incipient fracture commenced during endurance test on one side of shaft.
7894	212	.....do	11 A_3	52,460	85	End.....	21,640	145,230	.....	.09	.96	Granular.
7895	212	.....do	11 A_3	52,460	85	Middle....	21,040	141,210	.....	.08	.96	Do.

Gun specimens—Continued. Page.
10-inch steel B. L. rifles ... 37
Jackets ... 45–56
Tubes ... 39–44
Tabulation ... 57
12-inch steel B. L. rifles ... 59
Jackets ... 73–84
Tubes ... 61–72
Tabulation ... 85
Helical springs ... 225
Hotchkiss 4″.7 rapid-fire gun :
Specimens from exploded breech ... 311
Internal strains in experimental steel forging ... 229
Remarks ... 231
State of internal strains and stresses at different phases of the slice—
Breech slice ... 241
Breech slice, annealed ... 246
Breech-middle slice ... 238
Muzzle slice ... 235
Muzzle slice, annealed ... 245
Muzzle-middle slice ... 236
Total strains released as the rings were successively detached—
Breech slice ... 260
Breech slice, annealed ... 265
Breech-middle slice ... 256
Muzzle slice ... 253
Muzzle slice, annealed ... 264
Muzzle-middle slice ... 254
Supplementary tests after rings were detached—
Annealing tests ... 275, 276
Augmented compression ... 273
Tensile stress applied ... 274
Jasper. (See Building material.)
Limestone. (See Building material.)
Marble. (See Building material.)
Pig irons ... 181
Plaster of paris ... 390
Private tests ... 712
Railroad material. (See Track experiments.)
Receivers of rifles, .30-caliber, steel ... 137
Tabulation ... 144
Rifle-barrel steel, .30-caliber ... 87
Bessemer steel ... 101, 107, 108
Crucible steel ... 97–100
Crucible steel for pressure barrels ... 110
Rolled barrel, No. 32 ... 102, 103
Rolled barrel, No. 32, after annealing ... 104–106
Tabulation ... 113
Rolled barrels, specially treated—
Reheated in gas furnace and annealed in charcoal ... 117, 118
Rolled, and annealed in charcoal ... 119–122
Rolled, and annealed in air ... 123, 124
Annealed in lime ... 125, 126
Rolled, reheated in coal furnace and annealed in charcoal ... 127, 128
Rolled, cooled in air, heated in gas furnace, and annealed in charcoal. 129, 130
Reannealed in lime ... 131, 132

CHEMICAL ANALYSES.

Material.	Marks.	Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.	Aluminum.
		Total.	Graphitic.	Combined.						
Steel casting for 12" mortar carriage	12 C 197 C L_1 M	0.302	0.026	0.276	0.610	0.413	0.069	0.041	0.079	None.
Do	12 C 197 C L_2 M	0.301	0.023	0.278	0.539	0.376	0.054	0.021	0.077	None.
Do	12 C 204 C T_1 M	0.368	0.029	0.339	0.827	0.434	0.045	0.056	0.083	None.
Do	12 C 204 C L_3 M	0.243	0.027	0.216	0.475	0.342	0.045	0.027	0.078	None.
Steel casting	No. A	0.350	0.033	0.317	0.923	0.275	0.036	0.040	0.000	.....
Do	No. B	0.334	0.032	0.302	0.916	0.275	0.035	0.042	0.000	.....
12" jacket	5537 B_1 M T 9 O	0.568	0.014	0.554	0.697	0.144	0.033	0.024	.....	.....
Do	5537 B_1 B T 12 O	0.570	0.014	0.556	0.702	0.148	0.033	0.025	.....	.....
Do	5537 B_1 M T 11 M	0.562	0.014	0.548	0.683	0.144	0.033	0.024	.....	.....
Do	5537 B_1 B T 9 M	0.529	0.014	0.515	0.712	0.135	0.030	0.024	.....	.....
Annealed fragment of armor-piercing projectile	.....	0.358	0.021	0.337	0.258	0.185	0.017	0.046	.....	.....

SHOT LINES.

No. 5411.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 235.

Marks, 9 A.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	.....	
5,960	40,000	.0013	.....	
7,450	50,000	.0018	.0001	
8,195	55,000	.0021	.....	
8,940	60,000	.0025	.0003	
9,089	61,000	.0026	.....	
9,238	62,000	.0027	.....	
9,387	63,000	.0028	.....	
9,536	64,000	.0029	.....	
9,685	65,000	.0032	.....	
9,834	66,000	.0035	.....	
9,983	67,000	.0037	.....	
10,132	68,000	.0039	.....	
10,281	69,000	.0041	.....	
10,430	70,000	.0044	.0017	
10,728	72,000	.0052	.....	
11,026	74,000	.0059	.....	
11,324	76,000	.0065	.....	
11,622	78,000	.0072	.....	
11,920	80,000	.0080	.0046	
12,218	82,000	.0089	.....	
12,516	84,000	.0094	.....	
12,814	86,000	.0104	.....	
13,112	88,000	.0113	.....	
13,410	90,000	.0123	.0081	
13,708	92,000	.0134	.....	
14,006	94,000	.0142	.....	
14,304	96,000	.0154	.....	
14,602	98,000	.0162	.....	
14,900	100,000	.0176	.0128	
16,092	108,000	.03—	.....	
17,284	116,000	.04—	.....	
18,476	124,000	.05	.....	
19,668	132,000	.06	.....	
20,450	137,250	.....	.....	Tensile strength.

Elongation of inch section, ″.07.
Exterior diameter at fracture, ″.97.
Appearance of fracture, granular.